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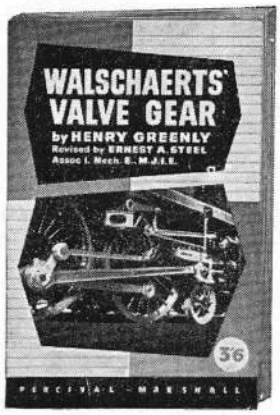

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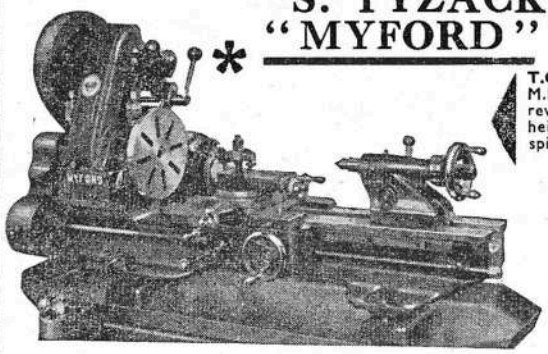

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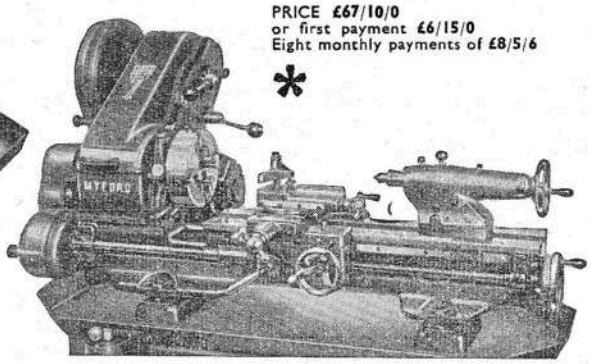

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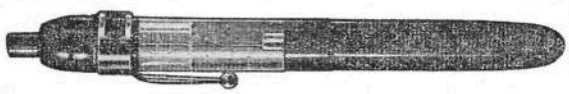

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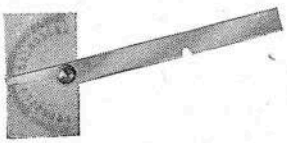

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IN THIS ISSUE

Smoke Rings 471
I sketched it on the way to Gallipoli 473
Ten years of the Tal-y-llyn 476
My small boring bar ... 479
Ship models where great liners are born ... 481
Watt meets Boulton ... 483
Locomotives I have known—The K class Moguls 486
Firefly—Crankpins to brake gear on the 5 in. and 4¼ in. gauge models 488
Canberra competition 491
A mixed bag 492
Black sand — Cooking kippers with the devil 494
Readers' queries ... 497
Postbag 499
Club news 502

COVER PICTURE

No 1 Tal-y-llyn and No 4 Edward Thomas double heading a train near Dol-goch. Robin Orchard writes of the progress made on the Tal-y-llyn. See pages 476 to 478.

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A WEEKLY COMMENTARY

Smoke Rings

By VULCAN

THE Railway Preservation Society has a noble ambition. It wants to preserve a Great Eastern Railway vintage train.

What it has in mind, declares its secretary Mr D. Noel Draycott, is an old type train—typical of those which operated on the suburban lines radiating from Liverpool Street—headed by a J15 0-6-0 tender locomotive from Stratford. The 0-6-0s gave years of service in and around London.

British Railways have a J15 which the society can buy for £900. It is estimated that £1,500 will be required to pay for the engine and a few suitable coaches.

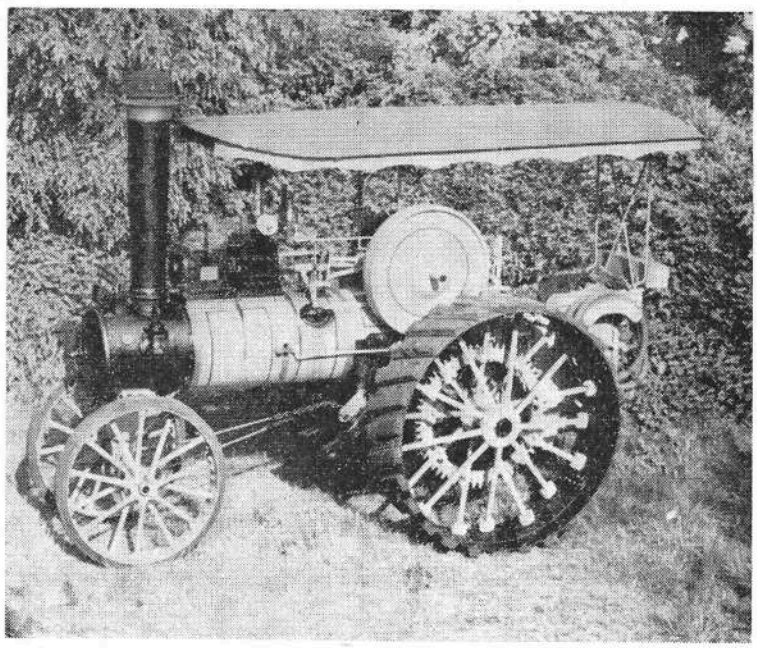
Tied in with this venture is the Railway Preservation Society's plans to expand. A London district branch is being formed as we go to press. Its main object will be to acquire a collection of rolling stock and relics associated with the early lines that served London and the South-east.

People who wish to join the new branch or who can offer assistance should contact Mr Noel Draycott at 3 Wansbury Way, Swanley, Kent.

Restored engine

THE small book *Traction Engine Pictures* by Anthony Beaumont (Percival Marshall and Co., 3s. 6d.) has been generally welcomed, and the reviews so far have been favourable. This is pleasing to me because Mr Beaumont is an enthusiastic supporter of model engineering and a fine photographer whose pictures have often appeared in our pages.

One of the pictures which is reproduced in the book is of a John Collings (Norfolk) steam tractor named *Bacton Hall*. It is a tandem compound dating from 1910.



BACTON HALL *now restored to its original glory*

The owner of the engine is Mr Ronald H. Clark, himself an engineer and a distinguished writer on traction engine subjects. I am indebted to Mr Clark for the later picture of *Bacton Hall*, reproduced here, showing the splendid way in which the engine has been restored.

National museum

SEVERAL times I have referred to the new museum at Clapham organised by the British Transport

Commission. Now, I am glad to say, the first part of it is open to the public.

The section, a two-storeyed building at the former bus depot at Clapham, houses models, pictures, maps, crests, tickets, timetables, uniform buttons, badges, posters and other small items which trace the evolution of transport through two centuries. There are six galleries.

In the bus garage itself will be the more majestic exhibits—locomotives, Royal railway carriages, buses, trams and canal craft. Many historic pieces have already been assembled but this large section will not be open until a much later date.

Among the models on view in the galleries already open are fine examples of *The Great Bear*, of Churchward fame, and a Lancashire and Yorkshire locomotive of 1899.

They were built by trainees at the apprentices training schools at Crewe as an exercise in railway engineering —a policy which has been advocated more than once in these columns. It is hoped that other models by apprentices will enrich the collection.

The venture is known as the National Transport Museum, and is open to the public from 10 a.m. until 5.30 p.m. on weekdays. Admission is 1s. for adults and 6d. for children. Entrance to the galleries is in Triangle Place, off Clapham Park Road, the nearest Underground Station being Clapham Common.

Young owners

ONE generally thinks of traction engine owners as middle-aged men, comfortably off, who find relaxation in the silky pulse of an efficient steam engine and the control of its superb power. But a youthful element is entering the lordly hobby.

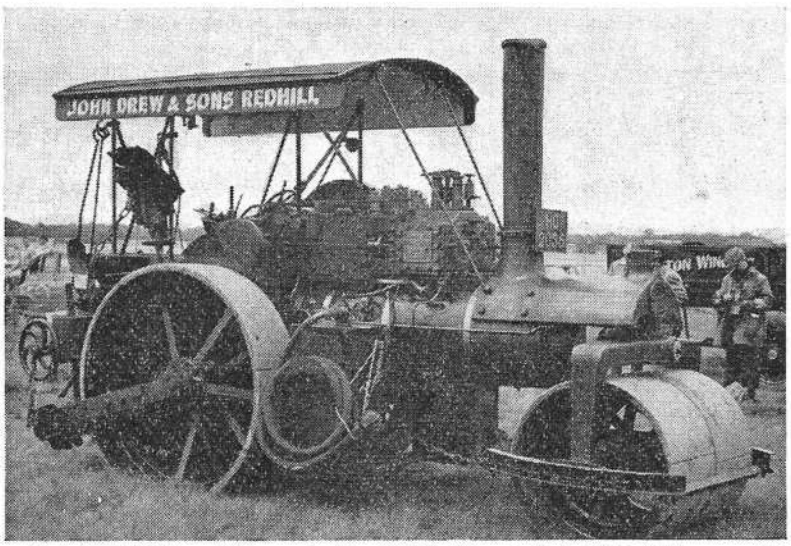
When I heard recently that a young lad up North had purchased a steam roller I thought it was an isolated case, but a letter from Christopher L. Edmonds, of Owlswick, Buckinghamshire, himself a sixteen-year-old, makes me wonder.

"It may interest readers," he says, "that sixteen-year-old Adrian Vickers, of Worthing, Sussex, has bought an 1898 Wallis and Steevens 10-ton steam roller. The machine is a single-cylinder, No 2524. Adrian got it from Mr Edney, of Horndean, but the engine has been at Mr Lugg's yard at Billingshurst for five years since it was purchased from Penfolds of Arundel. It would seem that a good many young people are preserving steam road engines and rollers."

Christopher has his own Burrell s.c.c. traction engine, bought in 1958, and he says that Michael Lugg, also sixteen, has owned a similar engine since he was eleven.

"Perhaps the engines," observes Christopher, "were 'knocked up by a blacksmith', as someone once remarked, but they were knocked up to last."

While this kind of enthusiasm exists the preservation of traction engines and steam rollers is assured.



Here is a Wallis and Steevens roller of 1921 *vintage which Adrian Vickers would no doubt like to drive. It is owned by Messrs S & J. Drew of Redhill and is a compound fitted with an oil bath. Photograph is by Mr John D. Sharp*

Next week

The April 27 *issue, on sale next Thursday, is an enlarged number (price* 1*s.* 6*d.) which will look ahead to the summer months. Authoritative contributors will review the trend in rallies and regattas and other special features will discuss work that can be done in the coming months. It is an issue you cannot afford to miss for it also launches a grand new competition with prizes to the value of* £150. *See the announcement inside.*

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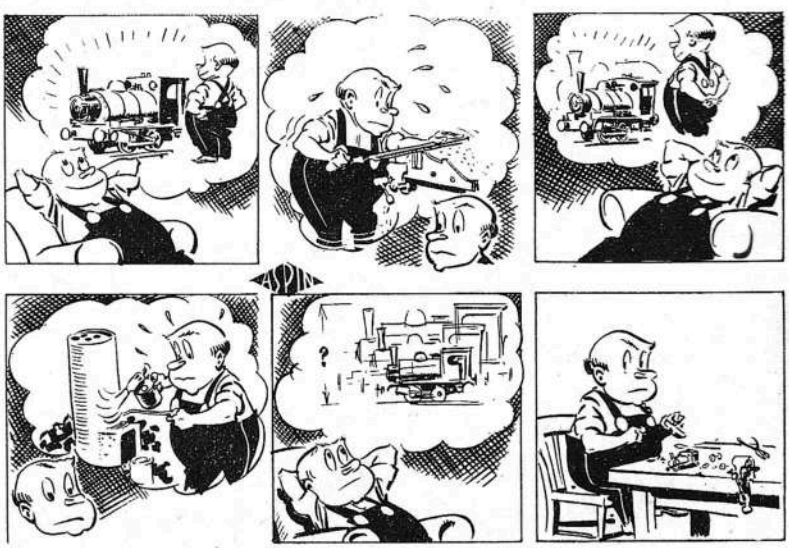


I SKETCHED IT on the way to GALLIPOLI

GEOFFREY K. KING returns to 1915 in the first of two articles on the portable engines used in France

IN France as in Britain, the portable steam engine grew in popularity during the second half of the nineteenth century and the first two decades of the twentieth. But it did not have the standardised form that it had in Britain, and as late as 1915 some manufacturers were producing a surprising variety of types.

Fig. 1 represents in outline an early pattern by M. Nillus of Havre, exhibited in Paris in 1867. It shows some typically French features which persisted in some engines until the present century.

The engine itself was an independent unit with a separate bedplate mounted on top of the boiler, a feature which was nearly universal on French engines but was seldom found in English practice, except in some large compound engines. It had a return tube boiler, a type rare in Britain but built as an alternative type in France up to at least 1915.

Its most interesting feature was the circular outer firebox with the immense steam dome over it, and the circular inner firebox with the slightly domed top, by which all stays were eliminated. This firebox was also adopted for direct flue locomotive-type boilers, and for many years continued to be popular in this use on French portables. The exhaust steam was led through a feed water heater. A more doubtful expedient, which apparently did not last long, was to lead the uptake to the chimney through the dome.

My first view of a French portable

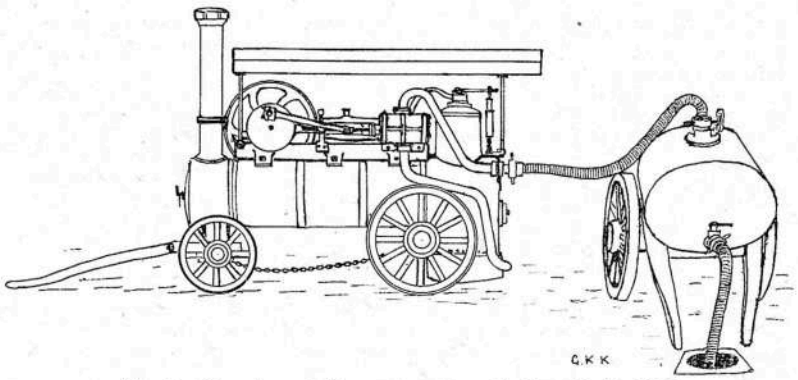


Fig. 2: French portable engine at work, Port Said, 1915

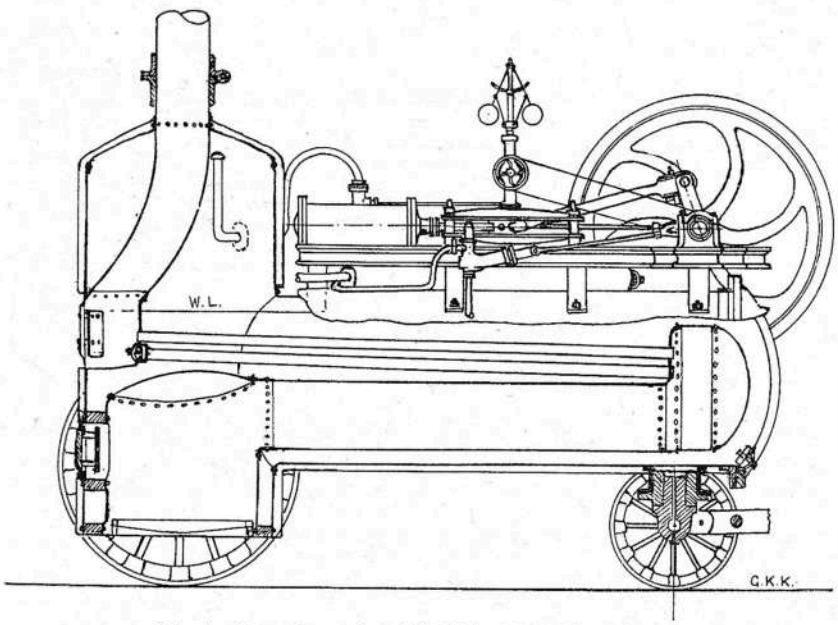


Fig. 1: Portable engine of 1867 by M. Nillus of Havre

was in early 1915 when I was passing through Port Said on my way to Gallipoli. I could not make a sketch on the spot, but I made one from memory a few hours afterwards. From it I have drawn Fig. 2. I cannot be sure of the correctness of detail as I had only a short look at the engine; I know that it had a large dome on which were mounted two spring balance safety valves, but I do not think it had the circular firebox. It had a single cylinder, four bar guides and a curved spoke flywheel on the right, while on the left-hand end of the crankshaft was a disc crank which drove a double-acting air pump through a forked connecting rod.

Maintaining a vacuum

The engine was engaged in the rather unsavoury task of pumping out a cesspool, the air pump maintaining a partial vacuum in a two-wheeled tank cart to which it was connected by a flexible hose, and another hose from the bottom of the tank passing down into the cesspool. It had one feature in which it was,

perhaps, superior to the internal combustion tank wagons used today: the exhaust from the air pump was taken by a pipe down into the ashpan and so through the fire !

The provision of a canopy over the engine may appear strange. Its purpose was to support canvas side sheets which served in some measure to protect the machinery from sand. In fact one of these sheets was in place on the far side of the engine when I saw it; the sheet prevented me from getting a good view of that side. I kept no record of the maker's name and I cannot remember it now.

Various types

The very varied types of portable engine made in France may be shown by the wide range manufactured by the Société Française de Matériel Agricole et Industriel, of Vierzon (Cherbourg). Of these, Fig. 3 shows what for years was apparently the most popular type in France; with detail differences only, it was built by many makers up till the end.

Fig. 4, a section through the boiler, shows the circular firebox, and Fig. 5, a perspective view of the engine. Its cylinder and crankshaft were fixed to a cast iron bedplate mounted on top of the boiler. The bedplate had a feed-water heater integral with it and heated by the exhaust steam, through which the feed-water passed from the crosshead pump on the far side to a check-valve low down on the front of the boiler. A belly tank, to which suction and by-pass pipes led, was provided under the boiler barrel.

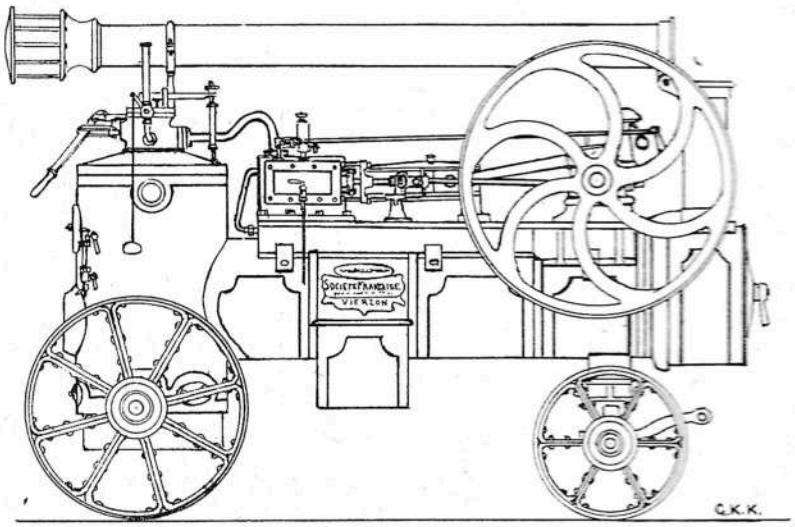


Fig. 3: Circular firebox and throttling governor. The engine seen in Fig. 5

There was a curved spoke flywheel on each end of the crankshaft. For throttle governing, the governor was placed just in front of the crankshaft, from which it was driven by spiral gears and controlled the throttle valve immediately above the steam-chest by a long horizontal rod.

The boiler barrel was rather small in diameter for its length. It had little steam space above the water level, but a large steam space was provided in the dome over the firebox, which was round with a domed top, to dispense with the need of stays. A casting on top of the dome carried two spring balance safety valves. It also carried the regulator, which was operated by a nearly horizontal lever at the back; from it the steam passed to the engine by a curved pipe. A whistle and a crutch for supporting the lowered chimney were also attached to this casting. A manhole at the back of the large dome provided access to the firebox crown. There were suitable mud holes above the foundation ring.

Such a boiler had, of course, a great advantage in eliminating stays, but the grate area was rather limited and it became less successful in the larger sizes. It seems to have had no counterpart in British portable engine practice, but the principle was perfected with modern materials and methods in the wonderful little steam wagon boilers designed in 1919 by F. J. Bretherton for Robey and Co.

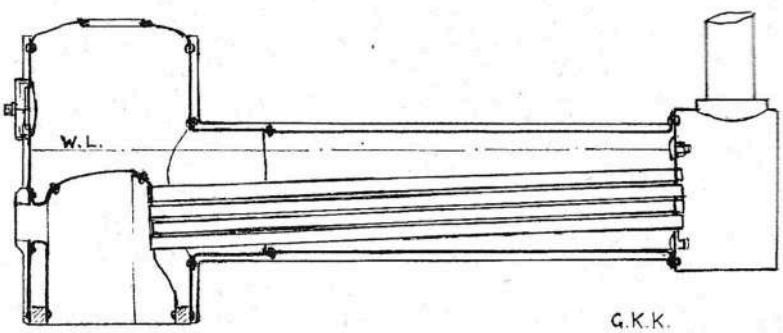


Fig. 4: Section through the boiler of the same engine

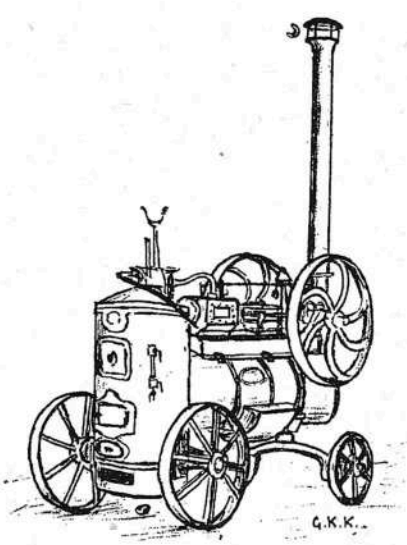


Fig. 5: Perspective view of a portable with a circular firebox and throttling governor. Société Francaise, about 1915

The engines were made in thirteen different sizes from 3-6 h.p., with cylinder 140 mm. × 270 mm., to 35-50 h.p., with cylinder 315 mm. × 400 mm. In three of them—8-16, 12-22 and 15-25 h.p.—an alternative type with an expansion governor could be supplied.

These alternative engines were of a slightly different design, with bored guides for the crosshead instead of the four-bar system used on the other engines. The governor was placed

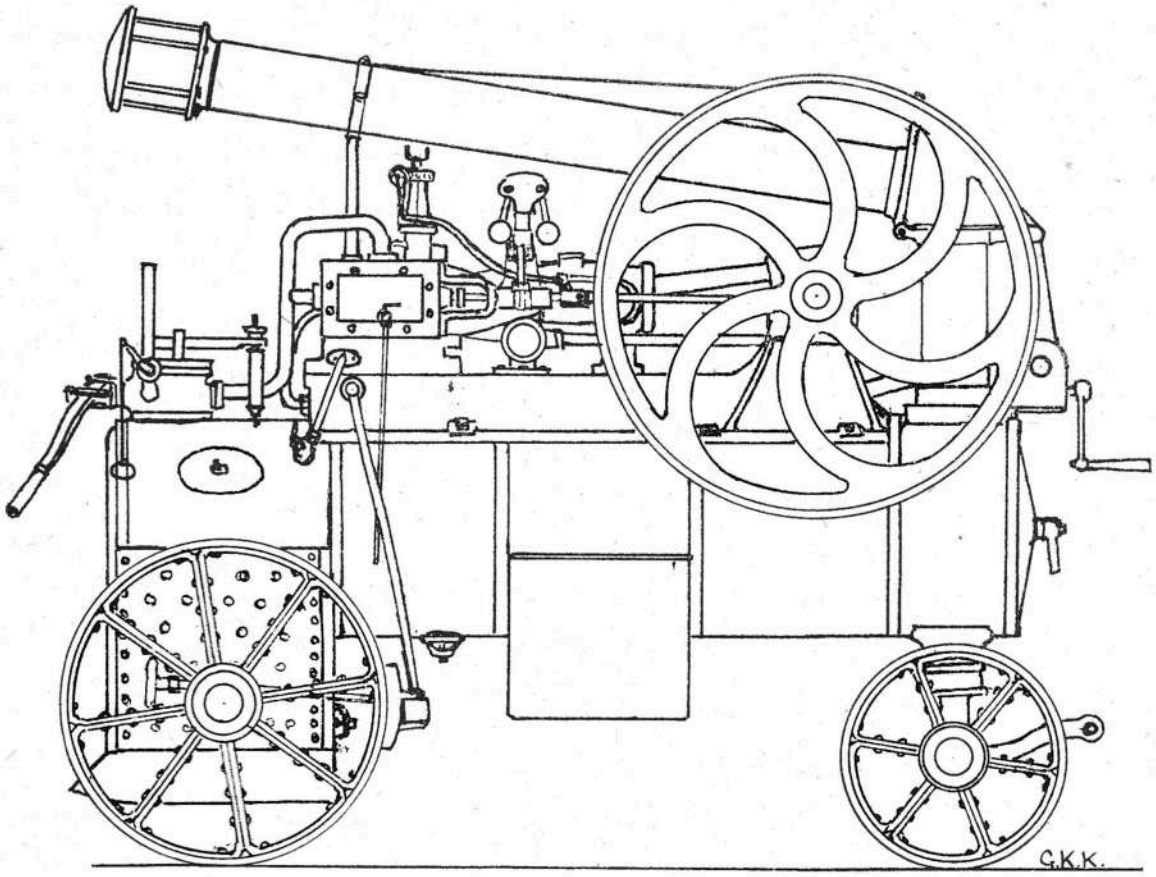


Fig. 6: *Portable engine with rectangular firebox and expansion governor. Société Francaise, about* 1915

alongside the valve spindle guides. It was still driven by spiral gears from the crankshaft, but through the medium of a horizontal shaft and a pair of bevel wheels in the governor base.

Controlling cut-off

Two valves were employed, a main valve and an expansion valve each driven by its own eccentric. The ports in the expansion valve and the back of the main valve were cut at an angle of 45 deg., so that by moving the expansion valve through a small distance at right angles to its normal travel the point of cut-off could be varied. This transverse movement was effected by turning the valve spindle about its axis, the movement being controlled by the governor. The cylinder was provided with a steam jacket, and these engines had mechanical lubricators.

Any engine could also be given a boiler with a rectangular firebox, more in accord with English practice. This firebox was particularly recommended for travelling sawmills; the increased size of the firebox enabled wood to be burnt.

Fig. 6 shows an example. The rectangular firebox had, of course, the usual side-stays, but the crown was of the self-supporting corrugated type, as used by Garretts of Leiston.

Steam was taken from a small dome on the boiler behind the cylinder, which also carried the two spring balance safety valves and housed the regulator. The drawing also illustrates the expansion-governed version, with the bored guide, the arrangement of the governor and the pipe connecting the steam jacket to the boiler. I believe that the brake to the rear wheels could be fitted to any type. The chimney raiser was supplied only with engines of over 8-16 h.p. The road wheels remind us of railway wagon wheels 40 years ago.

Two further types were made. One had a return tube boiler, and the other was an advanced model with superheat and drop-valves.

★ *To be continued on May* 4

LOCOMOTIVE NEWS

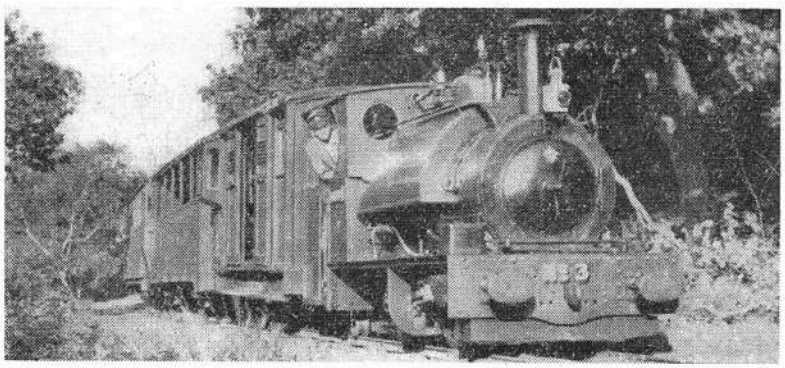
ON the Western Region heavy scrapping continues. On a recent visit to Swindon, locomotives of the 57XX class 0-6-0 PT, 5100 class 2-6-2 T, 4500 class 2-6-2 T, 1361 0-6-0 ST, 1366 0-6-0 PT, 42XX class 2-8-0 T and 15XX 0-6-0 PT were in store presumably for breaking. There were also some 72XX class 2-8-2 Ts on shed in very poor condition. Could these be the first of the class to go ?

An interesting withdrawal just at this time is No 18000, the first gas turbine locomotive in Britain. Built by Brown Boveri, using parts supplied by the Swiss Locomotive Company in 1949, it first appeared in this country in 1950 and subsequently spent most of its life on the Western Region. It was rated at 2,500 h.p. and was reputed to be capable of 90 m.p.h. speeds.

It was not altogether a success, but then first-timers are not usually, but I have no doubt that much important information was gathered and has been invaluable in the design of the new gas turbine locomotive GT3.

There is no intention to scrap the engine at present. In fact at Swindon recently it was in running condition (or should one say in gas ?)—R.O.

TEN YEARS OF THE TAL-Y-LLYN



Thanks to railway lovers, the little line which once hauled slate down from the mountains is carrying more and more passengers through some of the finest scenery in Borrow's Wild Wales. The story of its success is told by ROBIN ORCHARD

Sir Haydn at Abergynolwyn

As the summer of 1950 drew to a close, so did the life of the Tal-y-llyn Railway. Born in 1865 for the purpose of carrying the grey gold from the mountains of Merionethshire, this 2 ft 3 in. gauge line had survived all the trials and tribulations of the difficult years of the first half of the twentieth century. But now with the death of its benefactor, Sir Henry Haydn Jones, it seemed doomed to fall for ever into oblivion.

What happened to save the railway from this fate is by now common knowledge. The Tal-y-llyn lives on, and is now in the happiest state that it has been in since it began. The name " Tal-y-llyn " evokes the scenery of North Wales, and it is as much a part of a Welsh holiday to ride on the railway as to climb to the heights of old Snowdon. People from all over the world visit this friendly little line which, until the formation of the Tal-y-llyn Railway Preservation Society, was an insignificant relic of Victorianism left behind in the rush of modern progress.

Bright future

The railway has flourished a full decade since the grey clouds of 1950, and the future looks like clear skies all the way. This is, therefore, a good time to review the last ten years and see just what has been achieved by the group of enthusiasts who give up leisure and money so that the Tal-y-llyn shall live on.

Nothing better reveals the progress made than a glance at the traffic figures. In 1950 it was claimed that the railway had had a good year, having carried 5,235 passengers; today the figures are more than 13 times that total.

In 1950 the track was merely rust-filled ruts. Today, although not excellent by main-line standards, it is rapidly becoming better as newer and more suitable materials can be obtained.

The locomotives in 1950 were on their last legs and the rolling stock was running more by the grace of God than because of careful maintenance. Today there are five steam locomotives on the railway, for this is one line which is pledged to steam operation for ever. No 25 kV electrification for the Tal-y-llyn !

At the beginning of the decade there were only two locomotives, or rather one and half, as No 1 had been out of service for some years and was merely a rusty, dilapidated shell. Now there are three locomotives in excellent condition. Another will be joining them this year, and the fifth will soon be overhauled.

The locomotives

The first locomotive on the company's list is No 1 *Tal-y-llyn*, an 0-4-2 ST built in 1865 for the railway by Fletcher Jennings Ltd of Lowca Works, Whitehaven, Cumberland. It was returned to service in 1958.

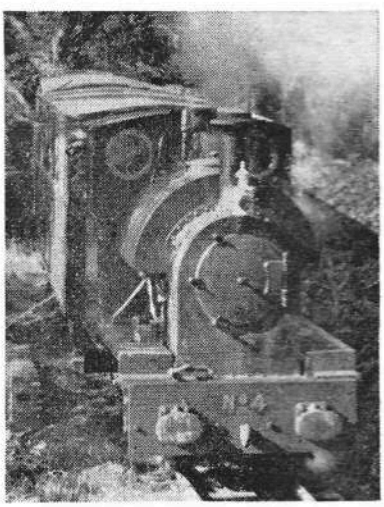
No 2 *Dol-goch*, second of the two original TR engines, was also built in 1865 by Fletchers; it differs from No 1 by using an 0-4-0 WT with the rear axle set behind the firebox. This is the engine which will be returning to traffic this year. It worked on the railway for the first few years of the decade, and was withdrawn in need of extensive overhaul.

No 3 *Sir Haydn* is another 0-4-2 ST. It was built in 1878 by the Falcon Locomotive Works, Loughborough for the Corris Railway. In 1951 it entered service on the TR following a period during which it had lain derelict after the closure of the Corris, in 1948. It ran until 1956 and has now been withdrawn for boiler repairs.

No 4 *Edward Thomas* was built in 1921 by Kerr Stuart Ltd, for the Corris Railway. It was put into service on the TR in 1951 and has worked every year since. Today its appearance is slightly different from ten years ago because it has been fitted with an Austrian device called an Giesl Ejector which makes steam locomotives burn coal more efficiently.

No 5 *Midlander* is a diesel used for works trains.

The final locomotive, No 6 *Douglas*, was built in 1918 for the Calshott Railway. It entered service in 1955, and has worked continuously over



EDWARD THOMAS *approaches Dol-goch*

the past few years. It is an 0-4-0 WT of a charmingly antiquated design.

Ten years ago the passenger stock numbered five vehicles. Now it numbers 17. This means that every year another vehicle has been added. Yet even this is not enough to carry all the people who want to travel on the line. The orginal stock consisted of three 18-seat four wheelers built in 1865 by Brown Marshalls, one 18-seat four-wheeler built in 1870 by the Lancaster Wagon Company, and the famous brake-van-cum-ticket-office built in 1865 by Brown Marshalls. To these have been added a four-wheel brake van made in 1878 by Falcon's for the Corris Railway, two 18-seat open four-wheelers which originally worked on the Penrhyn Quarry Railway (there were originally more of these units but they have been replaced by new ones), a closed bogie coach which was made at Towyn and seats 40 passengers, and an open bogie coach which has a brake and will seat 34. Three open four-wheelers, each for 24 passengers, have been built at Towyn and added to the list, together with two four-wheel closed coaches originally built for the Glyn Valley Tramway (closed in 1935) by the Midland Railway Carriage and Wagon Company. Each of these coaches has room for 12. At present another two coaches are approaching completion—an ex-Corris Railway bogie coach of 1898 which seats 24 passengers and an open bogie coach which seats 40.

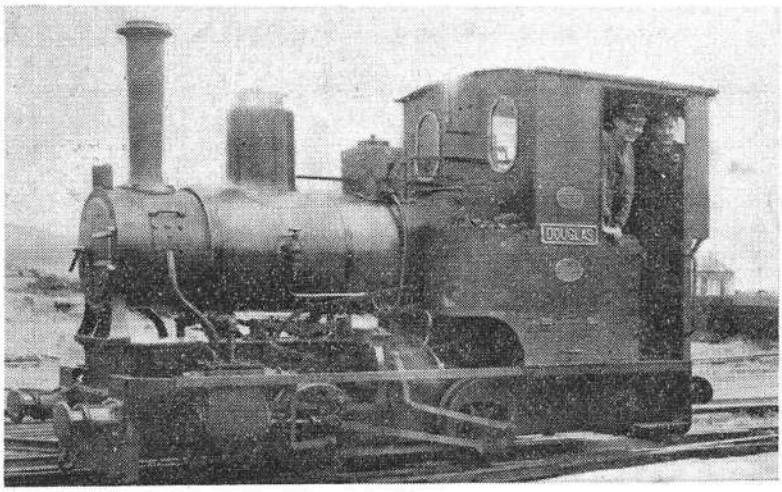
Changes

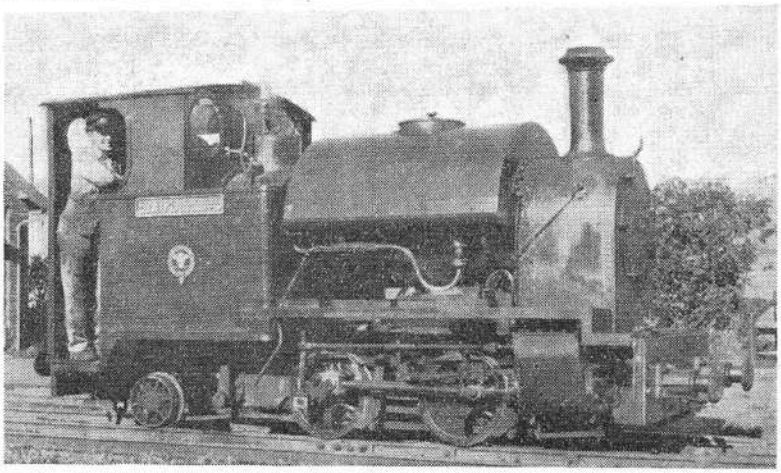
Plans are in hand for the building of more stock so that the original coaches can be taken out of general use and reserved for special occasions. The actual facilities of the railway have changed little beyond necessary repairs. This is not a fault, as the main idea of the railway is to preserve its typical Victorian atmosphere.

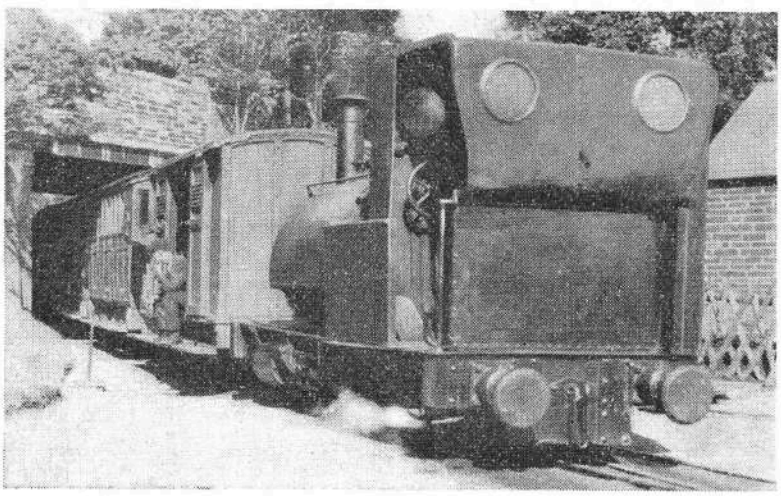
The western terminus of the line at Towyn Wharf has seen the most change. A little room has been built on to the back of the main office building for storing equipment. Next to it stands a new building cunningly disguised as an old one; it houses the narrow gauge museum, the largest collection of narrow-gauge relics in Britain. This alone is worth a visit.

Apart from these improvements, the buildings remain as they were. The track layout has altered; the old layout could never have coped with today's traffic.

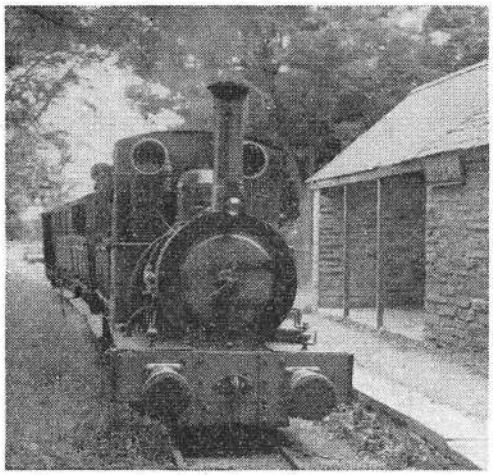
At Pendre, the heart of the railway, nothing has changed very much. The engine shed, works and carriage shed remain as they were in 1865. On the other side the old has given way to the new; where once stood the barn, long the home of No 1, a new carriage shed

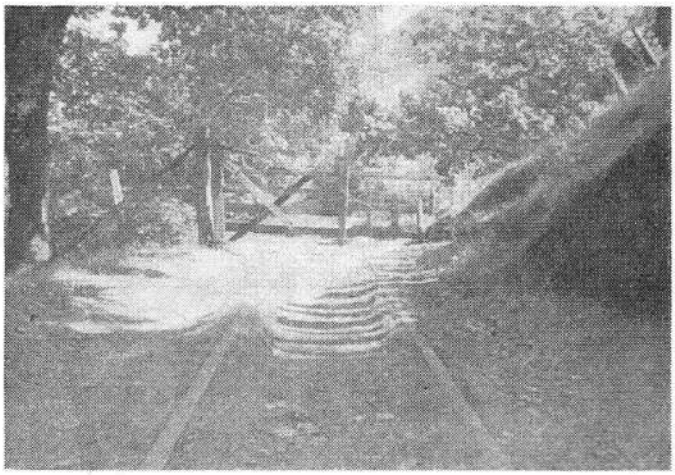






Top to bottom: DOUGLAS *at Towyn Wharf. Built by Andrew Barclay in* 1918; *used on the RAF railway at Calshott; presented to the Tal-y-llyn in* 1955. EDWARD THOMAS *at Towyn Wharf. This is the Society's busiest locomotive. In the Thirties:* TAL-Y-LLYN *running into Wharf Station with the old stock*





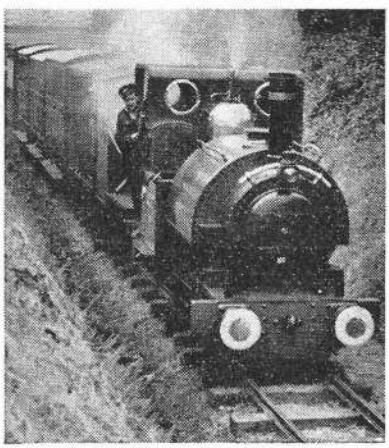
Left: DOL-GOCH *at Rhyd-y-ronen in the early days of the Society. Right: The closed mineral section, which may be re-opened, leads back to the gnomes. All the track looked like this ten years ago, before the rescue*

now stands. Here it was more important to protect the stock of the line than to worry about character.

At Rhyd-y-ronen and Bryn-glas, little has changed. Apart from the loops to the west of the stations, and the posters, it would only require a change of costume for the scene to be thoroughly Victorian.

Beauty spot

Dol-goch is undoubtedly the beauty spot of the line. Here one can sit in solitude and listen to the crashing waters of the falls. Again it is only the costume that is different. For the Dol-goch is far, far older than the Tal-y-llyn. Finally, at the upper terminus of Abergynolwyn, although the track layout has altered slightly the general character remains unchangeable.



TAL-Y-LLYN *draws near to Towyn Wharf*

What of the future? The most important project is the proposed extension of the line to a point which will give better access to the beautiful falls and water courses of the Nant Gwernol. One day, perhaps, *Tal-y-llyn* may be simmering beside Tal-y-llyn Lake.

Whether this happens or not, one thing is assured—the success of the railway, provided that the level of financial and physical support is maintained. In four years' time the line is 100 years old. It looks all set to reach 200, yet ten years ago there seemed little likelihood that it would see 86. What is more, the success has been achieved without the loss of any of the Victorian character of the line. The Tal-y-llyn can truly be called a little bit of Yesterday preserved for the pleasure of the Present. ▣

WIN

A SUPER 7 LATHE

See next week's

BE-A-JUDGE COMPETITION

HOW do you rate your skill as an exhibition judge? Next week you will have an opportunity to put your ability to the test.

A grand free competition, in which the first prize will be a Myford Super 7 lathe, is to be launched in Model Engineer for April 27. It will ask readers to try their skill at assessing the relative merits of models, having regard to certain faults. The idea is original and is bound to arouse great interest. Altogether, prizes worth £150 will be given away.

The Looking Ahead Number, as the April 27 issue is called, will be enlarged 56 pages and will contain several authoritative articles reviewing the trend in present-day rallies and regattas. Other articles will discuss the kind of work that can be undertaken in the coming months. For next week only, the price will be increased to 1s. 6d.

It might not be wise to rely on the casual purchase of next week's Model Engineer. There is bound to be a heavy demand for it. On the previous occasion that ME ran a big competition it sold out early and a great many readers were disappointed.

Thousands of extra copies will be printed, but the safest plan, if you have no regular order, is to pick up the telephone now and ask your newsagent to reserve Model Engineer for April 27. ▣

LARGE HOME-MADE MICROMETER

WORKSHOP HINTS and TIPS

By GEOMETER

MAKING equipment to measure to a high standard of precision is not so difficult as it might be thought by anyone who has never attempted it—a fortunate circumstance for those who need accuracy on dimensions beyond the 1 in. of the popular standard micrometer and cannot afford additional equipment.

Most micrometers, of course, have threads of 40 t.p.i., which are the same as those employed for many model fittings, and are specified when nuts are to be run on thin-walled tubes, or when they are to be screwed into the tube plates of boilers. Commercial taps and dies for cutting these threads produce excellent results when they are used with ordinary care and skill, and so it is quite practical to use them for micrometers.

The principle by which measuring to 0.001 in. is obtained on the ordinary micrometer can likewise be followed in the home-made equipment, by providing a similar thimble or sleeve, or even a disc, divided into 25. Then 40 (t.p.i.) × 25 equals 1,000 (1 in.), with one division giving 0.001 in. Dividing can be done from any change wheel with a suitable number of teeth.

Having settled the principles and decided means for producing the more important parts, you can consider the general design. Here simplicity, solidity, and built-up construction have much to recommend them, with all parts made separately. This tends to confine the scope of errors; and you can use the "measuring head" for a purpose other than the one originally intended.

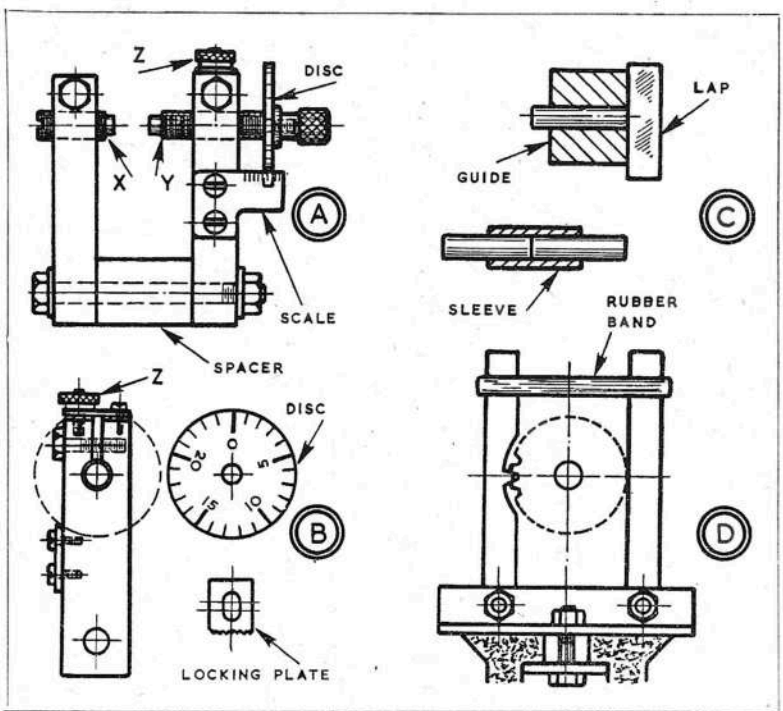
A large home-made micrometer, as at *A* and *B*, provides an example. The frame or body can be built up from two pieces of rectangular mild steel bar, with a steel distance piece or spacer bolted between them. The length of the spacer controls the gap of the micrometer, and so by having a number of such spacers, each longer than its predecessor by the movement of the micrometer spindle, measurement is possible over an extended range. In addition, the head bar carrying the micrometer spindle can be used in other precision equipment by making provision to bolt or clamp it on.

Both pieces of bar, which with the spacer form the frame, are drilled and tapped 40 t.p.i., when clamped to the faceplate, the one for anvil *X*, the other for spindle *Y*. Each is slotted from the end and is fitted with a screw for closing the slot, the anvil being gripped firmly (after setting) and the spindle adjusted to a smooth working fit. Locking the spindle to hold a setting is done from a threaded plate in the slot of the head bar—the plate being forced down by another when the knurled nut *Z* is tightened. The head bar carries a scale, with 1/40 in. divisions, against which registers the disc on the spindle with its 25 divisions.

Mild steel can be used for both anvil and spindle, though the working end of each can be casehardened. For a high-quality fit, spindle threads can be produced slightly oversize—regulating the opening of the die—and finished by lapping with fine abrasive compound using a split brass or aluminium lap.

Lapping can also be the means of finishing the gauges by which the micrometer is set. These can be of mild steel rod, carefully faced a few thou overlength. Then a guide block can be faced, drilled, reamed, or bored in the chuck, so that a gauge can be pushed through it, *C*, for a brass or aluminium lap to be used at the end. Two accurate gauges in a sleeve give 2 in.; if the micrometer has 1 in. movement, it can be opened to 3 in. Three gauges give an initial 3 in. and the micrometer an ultimate 4 in., and so on.

For dividing, the disc (which is gripped by a knurled nut to the spindle) can be mounted with a change wheel on a mandrel. If you lack other means of indexing, the arrangement *D* can be rigged, using angle iron to the lathe bed and two bars held together by a rubber band. ▣



My small BORING BAR

A device by P. E. WHITE for cutting small diameters

HAVE you, too, had trouble with minute screws in boring bars designed to cut small diameters and blind bores? Having tried several types, I decided to make one, using a rod inside a sleeve with a transverse hole through each to grip the tool bit—on the same principle as that which holds the scriber in a scribing block monkey.

The sleeve was faced in the lathe and drilled 17/64 in. dia. as far as possible. Then the inside was chamfered at 45 deg., using the lathe compound slide (a large centre drill would have been quicker). The other end was drilled and reamed. I used a home-made silver steel scarfed reamer, as this produced a really snug push fit with unmachined ¼ in. dia. bright mild steel bar.

At this stage I left the inner bar long and threaded it with a tailstock die holder. It could equally well be cut by hand, or be screwcut first for thread alignment.

After being faced to length, the nut was milled to produce the flats —which could have been filed. I then drilled, tapped and turned the chamfer accurately, to centralise the nut at the end of the sleeve and allow the bar to be easily slid inside block *D*.

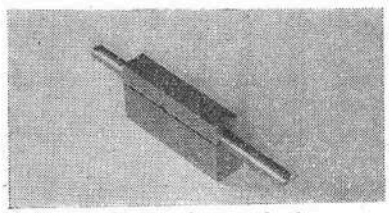
With the bar and sleeve assembled and held horizontally in the vice, a transverse ⅛ in. hole was drilled 1 in. from the back end of the tube. It needed care to get the hole centrally through the bar. Odd leg calipers were used against each vice jaw in turn, to mark out the middle of the bar, and the hole was started with a centre drill.

A piece of ⅛ in. metal (rivet) was inserted in the transverse hole and the nut was tightened. The bar and sleeve were locked and could be faced, chamfered and drilled together. I gripped the assembly at 45 deg. across the corner of a vice, marked the centre as before, and put a No 31 pilot drill through first, to prevent the ⅛ in. dia. drill which followed from cutting an oversized hole. Working with an endmill or slot drill might have been ideal, but by feeding the drill very gently when it broke through the other side of the work, the deflection effect of one-sided drilling was reduced to a minimum Should you wish to avoid the hole used to lock the components, you might try soft soldering the bar and sleeve together.

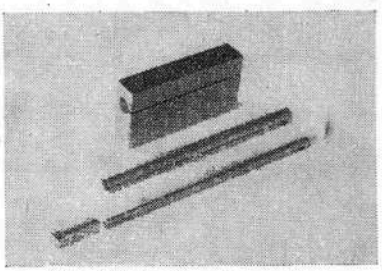
The larger-than-normal section of the block improves the rigidity of the bar and enables it to be set quickly, as no packing is needed if the centre height is machined to suit your toolpost. After machining to size, by turning in a lathe four-jaw chuck, I marked it out at one end, centralised it in the same chuck, and drilled and reamed.

It can be filed and drilled in a drilling machine if you have no four-jaw. You may then slit it by hand, or in the toolpost, using the boring bar in a stationary chuck, and traversing the saddle so that the lathe is employed as a planing machine. The feed could be added by moving the cross-slide at the beginning of each cut.

All parts were degreased, and lightly case hardened. After an unfortunate experience of some years ago, when a thin section was carburised right through, and broke in half immediately it was used. I now tempered all parts after hardening. A temperature of 150 deg. to 200 deg. C for 15 minutes is ideal. If your wife absolutely refuses to allow you near the cooker, heat the parts in sand, or on a metal plate, to a very pale straw colour after they have been hardened.



The boring bar and sleeve assembled in the block, ready for work on the lathe



This illustration shows how the individual items can quite easily be dismantled

The ⅛ in. dia. high speed steel tool bit is very cheap compared with larger diameters, and stands up to a great deal of hard work if it is ground to suitable angles. I used a front clearance of 6 deg., side clearance just enough to clear the hole being bored, a top rake angle of 5 deg. for hard metals, and 15 deg. for softer ones.

To avoid chatter and the accompanying bad finish, the nose radius on the tool has to be very small, and only the minimum amount of bar necessary for the work to be done should project from the toolpost. The tool will be more rigid when it is clamped to the top slide than if it is held in the American turnbuckle type toolpost. It may be found that, at a certain speed, harmonic vibrations of machine and tool also spoil the finish, and that the lathe speed should be altered.

I am delighted with the performance of the boring bar, and have found the time spent in making it well worth while. Other pieces of ⅛ in. dia. h.s.s. I ground with differing plan angles to form varying ends of counterbores and blind bores. The internal screwcutting bit is used in a second boring bar, which has the hole for the tool bit drilled square to the bar's axis. By merely revolving the tool bit, allowance is made for clearing the helix angles of both coarse and fine threads. ▣

SHIP MODELS

where great liners are born

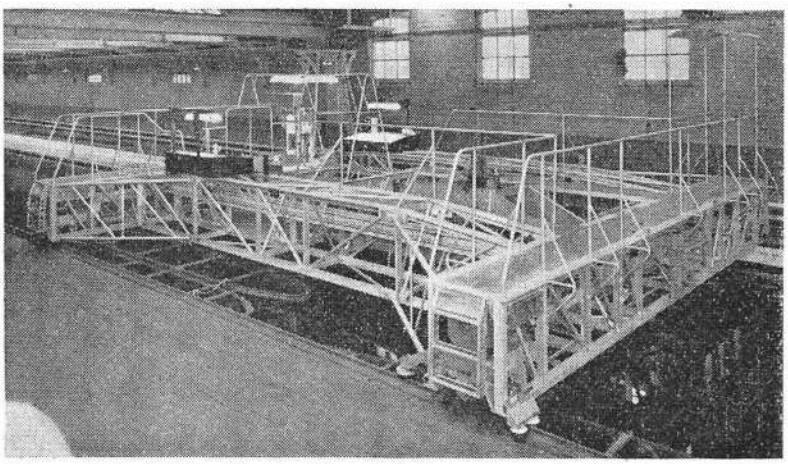
From a Special Correspondent

A NEW towing carriage has been installed in the ship model experimental tank belonging to John Brown and Co. (Clydebank) Ltd, as part of a continuous effort to keep their research equipment in line with the modernisation of their shipyard facilities. The new carriage is of light alloy and incorporates the most modern ideas in drive, control and instrumentation. It was designed by the tank staff and constructed in the shipyard.

Clydebank's experimental tank was established in 1903, and was among the first of the privately-owned model basins to be built. It was designed on the basis of the Froude tank at Haslar. John Brown & Co. have made many improvements such as the installation of a wave-making machine and the design and construction of special equipment for the making of model propellers, which have been constructed and tested at Clydebank since 1909. The propellers are of a size suitable for experiments with ship models of 200 in. in length. Some years ago a special unit was designed for the testing of 24 in. dia. model propellers in open water.

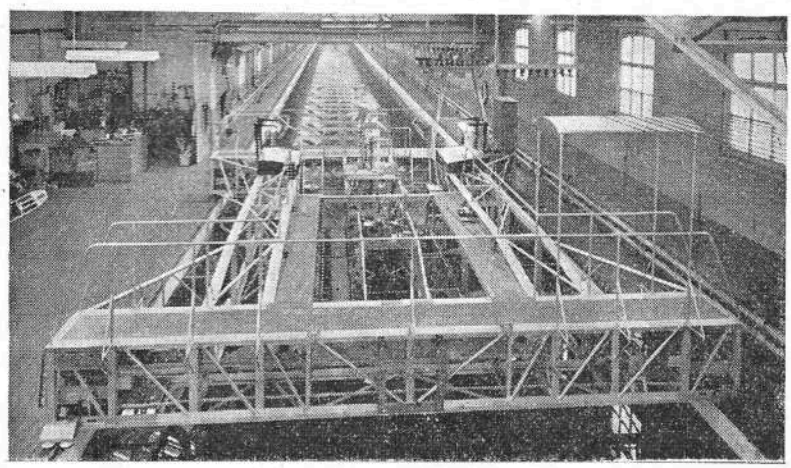
The first ship model made and tested at Clydebank was for the Cunard Line's first *Caronia*, which was launched in 1904. Research work carried out at the tank contributed to the design of many famous ships, among them the *Lusitania*, the *Aquitania*, the two great Queen liners, HMY *Britannia*, and the giant modern tankers.

Many contributions to the scientific study of problems affecting ship design and propulsion have been made by the staff at the tank. One of the earliest was the work of W. J. Luke, whose RINA papers of 1910, 1914 and 1917 on wake and thrust deduction are regarded as classics on the subject, in Britain and other countries. Experimental investigations carried out with the British Shipbuilding Research Association in more recent times include the comparison of various stern arrangements in single-screw vessels, the investigation of the effect of the bulbous bow on resistance, the carrying out of resistance tests on models of large block co-efficients, and the testing of launching greases. It can be expected that the tank will play an equally important part in the future.



New carriage for the ship model tank belonging to John Brown and Company

Below: New carriage ready on the tank



Nearly round the world

The original wooden carriage, which is now replaced, was designed by R. E. Froude. It is estimated to have travelled 21,000 miles in carrying out some 150,000 recorded experiments. The main attraction of the new carriage is the clean design and the large amount of space for operation and observation. It is so arranged that one half of the space houses the

permanent gear for normal resistance experiments and includes a new dynamometer and recording head. The other half encloses a large open space, for auxiliary trucks and other equipment used in special research programmes.

Light alloy—MG5 magnesium aluminium—was chosen to give the strength requirements and weight limitation for the new carriage. The complete structure was electric-welded throughout.

Four 5 h.p. electric motors drive the carriage. One is fitted above each driving wheel, and the drive is transmitted through heavy Renold duplex chain. The power supply is based on the Ward-Leonard loop system connecting a shore-based motor generator with the four carriage motors in series.

Speed control is achieved by regulating the voltage of the generator, the excitation of which is by a magnetic amplifier. With this arrangement the operator can pre-set the main speed control potentiometer at any desired final speed. Automatic acceleration is obtained simply by closing the main contactor. An overhead cut-off stops the carriage automatically at the end of the run. Push button controls are conveniently arranged at the operator's position on the carriage.

Current is supplied through a grid of 11 overhead wires, with the pick-up through miniature trolley boom collectors. This overhead grid supplies 240 v. a.c., 220 v. d.c., and 12 v. d.c. to selected points on the carriage. The whole of the electrical equipment was supplied by the English Electric Company.

Dunlop disc brakes are fitted to each driving wheel and operated from one master cylinder and solenoid. Separate manual units on the rear wheels provide for an emergency. ▣

I saw the last CNR steam train pull out of Montreal

reports DONALD PROUDLOCK

I WAS in Montreal when the last Canadian National train to be hauled by a steam locomotive left Central Station for Ottawa.

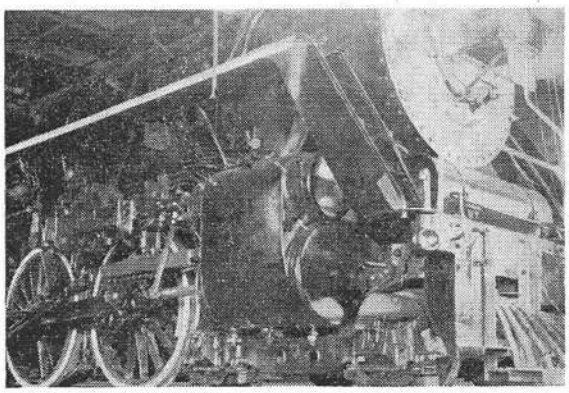
The locomotive, a Northern type No 6153, was of 1926 build. I was unable to discover why this particular one had been chosen. It had, of course, been specially overhauled and painted for the occasion. Mr Hounger was the engineer and Mr Kelby the fireman—highly coveted honours !

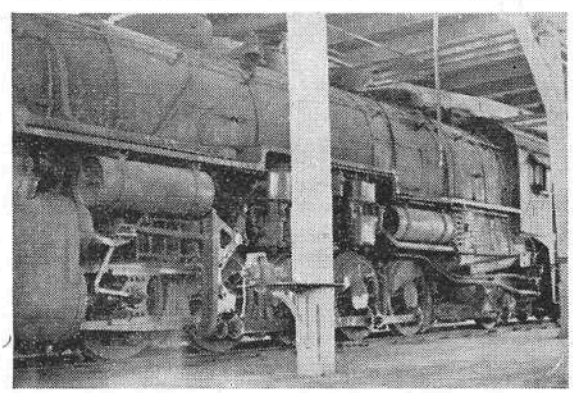
More than 450 people made the trip in the special train of eight cars. Many came from as far as the Western Provinces and the United States.

The run marked the end of an era which began 125 years ago, in 1836, when the first steam locomotive in Canada was put to work on the Champlain & St Lawrence Railway.

I was fortunate to be able to see the engine immediately before the run as the final adjustments were being made. She was a fine and imposing sight, and it gave me a great satisfaction to know that she was to be preserved.

My photographs were taken, in rather difficult conditions, at the roundhouse. The freight engine, a 2-10-2, is one of the CNR's largest, and the mere fact that she was in the roundhouse, and not outside in the scrap sidings with her sisters, gives hope that she too may be spared from the burner's torch.





CASTING ALUMINIUM AND BRASS

THE following information may be of assistance to readers like myself who wish to make castings in aluminium or brass.

The first important items are a copy of *Foundrywork For the Amateur* (Percival Marshall and Co., 5s.) and one or two plumbago crucibles. The two metals should not be melted in the same crucible. The book contains a wealth of information, and is well worth the modest outlay; the small type crucible is quite cheap also. Names and addresses of firms who will supply the necessary items will be found in the book. A small quantity of Coverall II, and Degasser 200 tablets should be obtained. Now proceed as follows.

Charge the scrap aluminium into the crucible with a sprinkling of Coverall 11 on the top and melt. When molten add another small amount of Coverall 11 and rabble, or stir, this well into the metal with a pre-heated stirrer. I use a length of 1 in. × ¼ in. iron, well flattened at the end and bent to form a skimmer. This can then be used for both operations.

Immediately the Coverall is stirred in, the dross, will come to the top in a red glowing mass and can be skimmed off. The metal is now ready to be degassed. Drop a degassing tablet on top of the melt and plunge it to the bottom with a cup-shaped plunger, a tool which can easily be made in the workshop. A bubbling action will commence with a certain amount of fuming. Keep the tablet at the bottom until this ceases, then skim the metal once more. This process leaves a pot of clean, shiny metal which is ready for pouring.

A number of castings have been made in my workshop and put to good use.

Regarding the casting of brass, a separate crucible with cover *must* be used. Aluminium is detrimental to brass. The cover is necessary to help keep down fuming and the pickup of furnace gases.

I cannot obtain the temperature to melt brass without the use of forced draught, although my stove makes use of an old chimney flue in the house. Something to blow the fire had to be made. It is a Heath Robinson effort, but it works quite well.

Charge the scrap brass into the crucible and cover with a quantity of Cuprex 1. This is a black powder which forms a flux over the metal and stops flaring and loss of zinc content. The metal should not be skimmed of dross and the flux covering; the dross should be held back and the metal poured from beneath it.

When the metal is ready for pouring it must be deoxidised. With a deoxidising tube D.S. plunge to the bottom of the melt, hold there for a short while, and the metal will then be ready for pouring.

Leaflets on the use of these chemicals can be had from Messrs Foundry Services Ltd. one of the firms mentioned in *Foundrywork For the Amateur*.—EDWARD L. FOSTER.

WATT meets BOULTON

IAN BRADLEY describes a happy partnership which had great consequences for the history of steam

CURIOUSLY enough, the only immediate practical benefit to result from Watt's epoch-making discoveries was an improvement in the Newcomen engine. The invention of the separate condenser gave this old machine a new lease of life for, once the condenser had been fitted, the engine began to show a marked economy in running, combined with the ability to make many more strokes a minute.

What was James Watt doing to commercialise his invention? Apparently he was not doing very much. His discoveries were made in 1763, and it was not until 1769 that he took out a patent describing his improvements to the steam engine under seven headings. This patent specification, besides being of great historical interest, is a classic statement of the principles that have influenced the development of the steam engine.

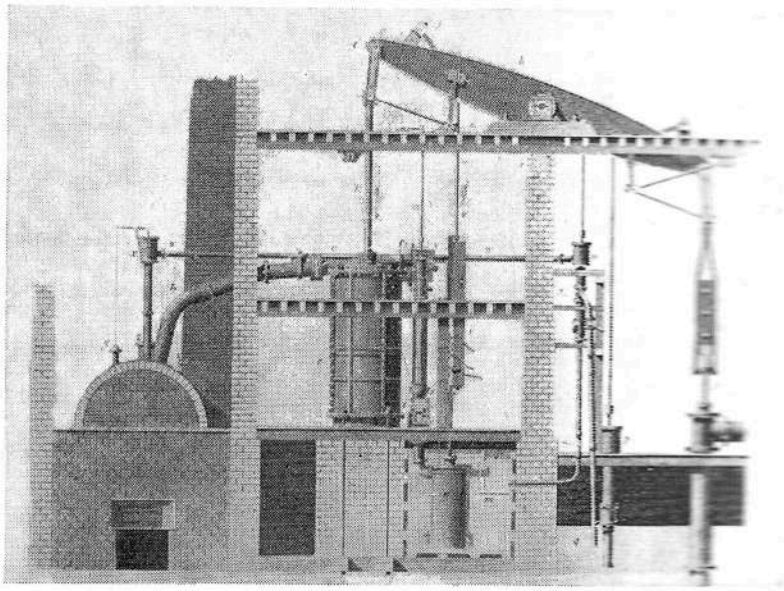
The first article in this series appeared on April 6

But we should not assume that Watt was taking no action whatever. Being methodical, he did not apply for his patent until he had made certain, on a full size engine, that all his claims could be substantiated. Clever mechanic though he was, he had no experience of heavy engineering and he freely admitted the fact. In addition, facilities for making the heavier parts did not exist within the university.

Watt had many disappointments before he overcame the engine's early troubles. His most experienced mechanic died, the beam of the engine broke, and many minor vexations came to plague him. He would no doubt have preferred to bear the cost of the experimental engine himself, but he was a comparatively poor man and could not afford to do so. Accordingly he began to look around for someone who would help.

There was no one to be found in Glasgow. But, through the good offices of Dr Black of the university, a man who had taken an interest in his work to the extent of lending him occasional sums of money, he was introduced to Dr John Roebuck of the Carron Iron Foundry.

This was a fortunate meeting. Dr Roebuck was not afraid to speculate if he thought that there might be some financial advantage. At the time of his introduction to Watt he was mining for coal on a large scale and had need of an engine superior to the Newcomen to keep the mine shafts free from water. After some parleying, he agreed to pay the debt of about £2000 which Watt had incurred in prosecuting his invention, and to provide the money to complete the experiments and secure the patent. In return he was to have two-thirds of any profits.



Watt's single-acting beam engine for pumping water (Tredgold)

Not without toil and tears the experiments led to the engine illustrated in Fig. 3. Watt seems to have been continually despondent of success, for the Carron Iron Foundry and others, "were wanting in skill to manufacture the parts of their full size with the requisite unity," as one authority says. He was somewhat temperamental by nature, and at this time was much beset by money worries. It took all that the more optimistic Roebuck could do to induce him to persevere. Through Roebuck's encouragement, he was able to complete the experiments, while he worked as a surveyor to maintain his family.

The engine in Fig. 3 had a cylinder *A* surrounded by a steam jacket to ensure that the cylinder was kept hot, and a piston *B* with a rod *C* kept steam tight by the gland seen in the cylinder cover.

In the upper and lower valve boxes *D* were three valves *E*, *H* and *G*, connected by a pipe *F*. The three were called the steam valve, the equilibrium valve, and the exhaust valve; they were operated by the levers E^1, H^1 and G^1, moved by tappets fixed to the plug frame *M*.

The condenser *J* was connected to the lower valve box by the exhaust pipe *I*. While the condensing arrangements followed closely the experimental apparatus made by Watt, in the full-size engine he used a water jet *K*, whereas in his experiments he had a surface condenser.

A condenser air pump *L* discharged into the hot well *N*, and was provided with the pair of non-return valves which may be seen in the illustration. The whole of the condensing mechanism was submerged in a well of cold water supplied by the pump *O*, while the boiler feed pump *P* drew its water from the hot well.

Piston, plug frame and main pump were connected to the beam by chains. As the engine was single-acting it was

necessary to counterweight the main pump rod to make certain that it was heavy enough to return the piston to the top of the cylinder after the working stroke.

Before the engine could be made to run, it had to be warmed up and steam had to be blown through the cylinder and condenser to drive all air from the system. This was done by opening all three valves *E*, *H* and *G*, thus allowing steam from the boiler to pass into the cylinder on both sides of the piston and thence into the condenser and through the air-pump from which the steam was discharged into the hot well. At the end of the blowing through, as it was called, the engine could be started.

The valve positions for blowing through are illustrated in Fig. 4, Stage 1. As soon as all the air has been driven from the steam passages, the exhaust valve *G* and the equilibrium valve *H* are shut. Because the parts are cold, the steam below the piston and in the condenser will have turned to water and a partial vacuum will form below the piston. The pressure of steam above will then force the piston to the bottom of the cylinder, at the same time drawing up the main pump rod. This completes Stage 2 of the cycle.

As Stage 3 begins, the steam valve *E* is closed and the equilibrium valve *H* is opened while the exhaust valve *G* remains shut. The steam on the upper side of the piston can now flow to the underside. Thus the pressures acting on either side are equal, and the weight of the pump rod is able to return the piston to the top of the cylinder, completing the stage.

At the beginning of Stage 4 the valve *E* is opened, admitting steam to the top of the piston. The equilibrium valve *H* is closed and the exhaust valve *G* opened. The steam below the piston now rushes into the condenser where it is turned to water by the condenser jet, which has been turned on for this part of the cycle.

Such, then, was the engine which emerged from Watt's final experiments. Alas for his hopes of making the machine a commercial success, Roebuck found himself bankrupt and unable to continue.

At this point, the invention might well have been stillborn but for a fortunate circumstance. Roebuck had some years previously drawn the attention of a Mr Matthew Boulton to the work that Watt was doing. Boulton was greatly interested in improving the performance of steam engines, for he was a Birmingham hardware manufacturer of some importance who needed an engine to provide a continuous supply of water for driving his works. He had himself investigated the possibilities of making a more efficient engine; but the labours of running a large business left him little time for experiment, and he was therefore delighted to be put into touch with a man who, from all accounts, had really achieved something in this direction.

Yet it was not until 1774 that Watt left Scotland and came south to take up his duties with Boulton in Birmingham. The times were out of joint, and the Birmingham manufacturer was unwilling to speculate; in the end he was virtually forced into doing it to get some redress for the debt that Roebuck owed him. Thus it was that Boulton found himself the owner of Roebuck's interest in the engine, and the partner of James Watt.

What a happy partnership it was ! Both men had conceived an instant liking for each other when they first met. Boulton, a shrewd judge of character, soon found that he could safely leave all the practical engineering to Watt who, in turn, was glad to have the experienced Boulton looking after the business side.

Another very great advantage sprang immediately from this association. Hitherto the engineering establishments carrying out experimental work on the steam engine had been singularly ill-equipped to deal with the wide range of operations needed to produce the parts. In Birmingham—even then the centre of engineering—all the skill, experience and tools were to hand. But James Watt was not easily satisfied; he returned defective castings to the foundry and badly-

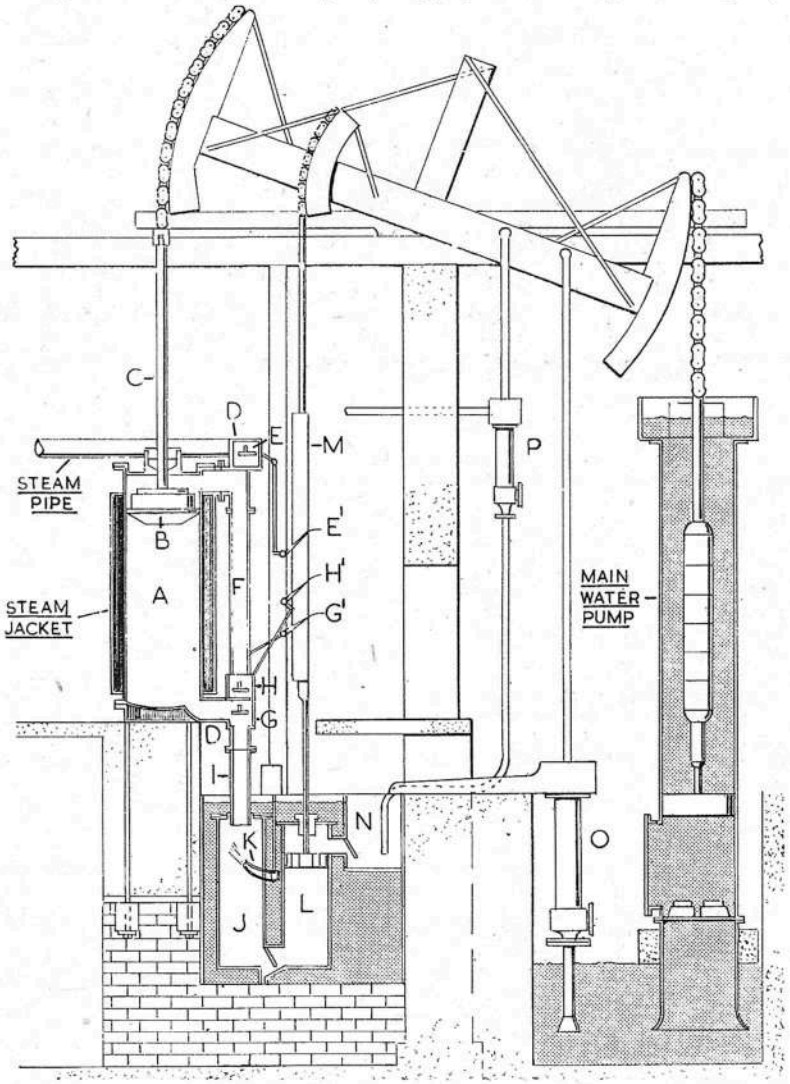


Fig. 3. *Diagram of the single-acting pumping engine*

finished parts to the workshops with blistering letters of criticism.

John Wilkinson, a noted iron founder, had perfected a system of casting the engine cylinders and had also devised a machine for boring them accurately. This was a notable advance, for until then the cylinders had to be finished by hand. The results were so far from perfect that a liberal application of tallow and old felt hats was needed to keep the piston steam-tight.

Watt said that the average error amounted to $\frac{3}{8}$ in. out of round. Wilkinson's boring machine reduced it to rather less than 1/10 in.; a figure that greatly simplified keeping the piston steam-tight.

The hand-finishing methods formerly employed were arduous, as we learn from the diary of Thomas Reynolds, an engine erector. Writing in October, 1760, Reynolds describes how he began to "scour the bore of a great cylinder of an engine" for pumping the water from a coal pit. The cylinder had a bore of 28 in. and a length of 9 ft. There had already been three defective castings and the erectors doubted if the work could be done.

Success was finally achieved. Reynolds says that the cylinder was laid on its side on two baulks of timber, and a lump of lead, weighing about 3 cwt, was cast inside it to conform with the curvature of the bore. Iron bars for securing ropes having been cast in the lead, six men laid hold of each rope and pulled the lead lap back and forth inside the cylinder, which had been smeared with emery and train oil. After a little while, the cylinder was turned on the wood baulks to present a fresh surface to the lead lap, and the whole process was repeated until the bore of the cylinder was considered to be sufficiently smooth.

The first engine ordered from the Soho Works was for blowing the bellows of John Wilkinson's ironworks at Broseley. Great care was taken with its construction, for its success or failure would have lasting results. It worked admirably and established the name of Boulton & Watt in the Midlands. Enquiries for engines began to come in, notably from Cornwall, where the Newcomen Engine had fallen into disfavour because its performance was uneconomic.

It quickly became apparent that some form of production schedule should be drawn up. We find the firm ordering supplies of castings from Wilkinson in order to maintain their programme.

At about this time, in 1776, Watt returned to Scotland to be married for the second time. While in the North he succeeded in getting orders for several engines. It was fortunate that Matthew Boulton was a capable man, for during Watt's absence the whole of the practical administration of the engine works devolved upon him, in addition to his duties as manager of all the other departments.

When Watt finally returned to Soho, he was immediately busy, organising the new workshops, making the detailed drawings of the engines, and generally superintending the fitters and erectors who were sent away to install the engines after their manufacture.

The installation was, in many ways, irksome, for some of the fitters proved to be men of little stability, and time that should have been given to erecting the engine was spent in drinking ale. It was determined that Watt should go to Cornwall, where most of the work and much of the trouble lay.

Unfortunately, Watt did not understand the Cornish; nor indeed was he particularly successful in dealing with most of his own workmen. As might have been expected, there was much trouble—Watt wanting to dimisss workmen, and, at the same time, thoroughly upsetting his Cornish clients. It says a great deal for Boulton's administrative capacity that, even at that distance, he was able to keep matters on an even keel and prevent his partner from performing some foolish act in the heat of the moment.

Despite these difficulties, the business prospered, for the somewhat disbelieving Cornish miners could not dispute the evidence of their own eyes that engines were drawing water from the mines as it had never been drawn before.

★*To be continued*

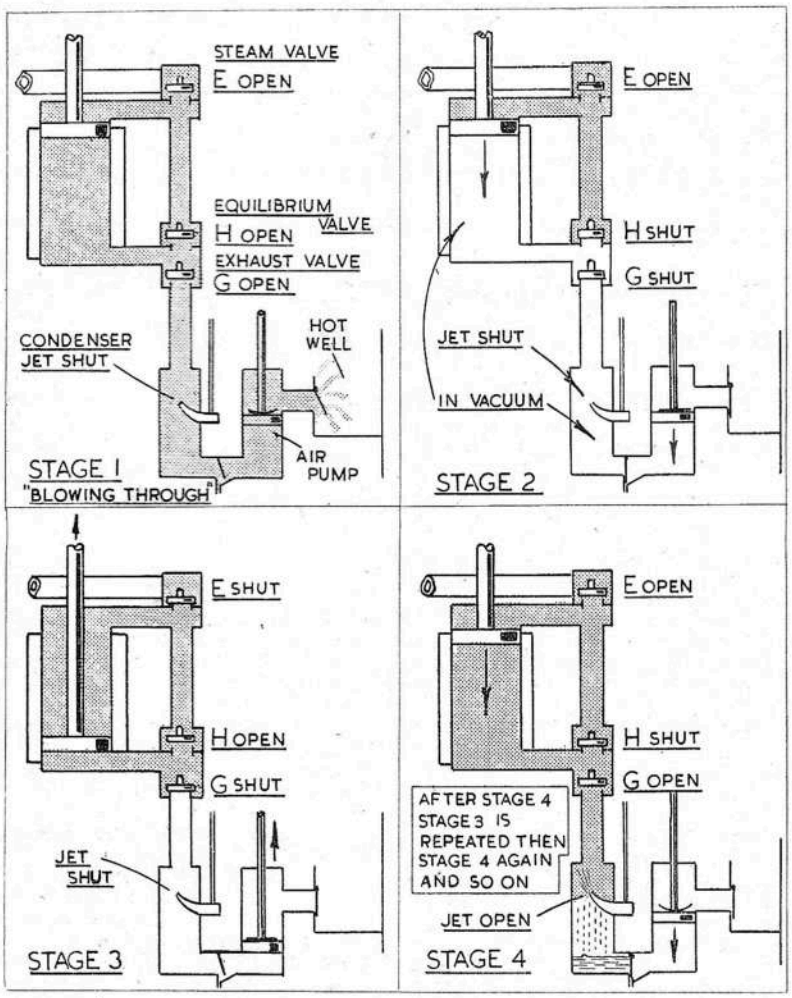
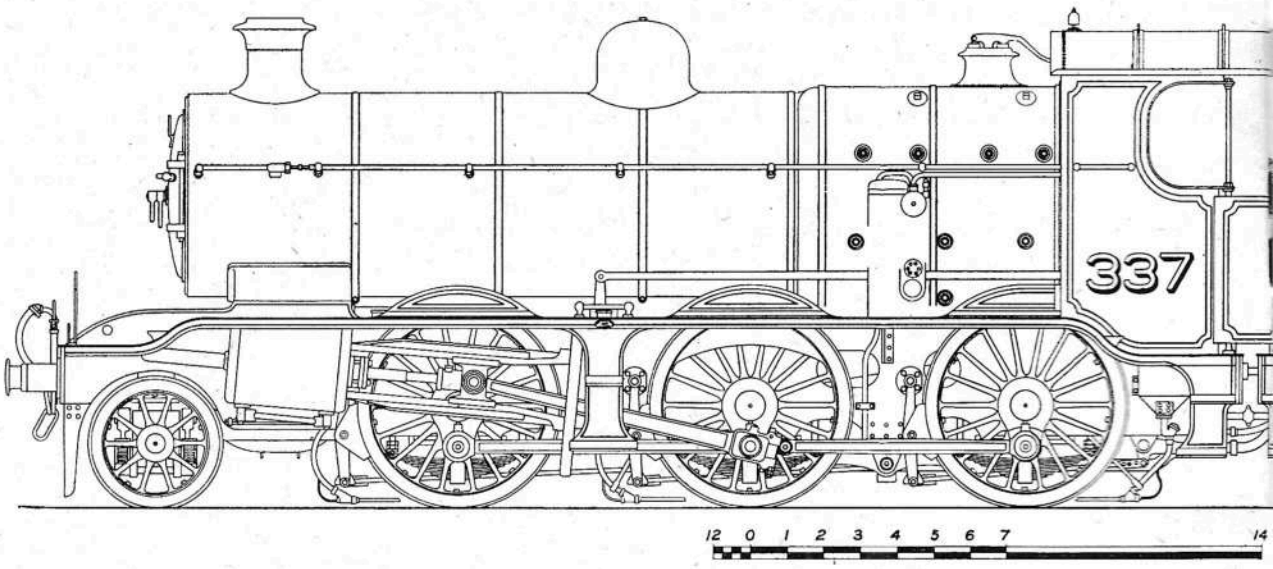


Fig. 4. Cycle of operation



LOCOMOTIVES I HAVE KNOWN

For old readers of ME
drawing which J. N. MAS

THE BR

CLASS K

WHEN, in 1911, G. J. Churchward brought out the first of his 4300 class 2-6-0 type mixed-traffic locomotives on the Great Western Railway, he inaugurated a type that appealed very strongly to the chief mechanical engineers of several other railways, who were not slow in noting the advantages of a moderately dimensioned general-purpose engine with a very wide scope; large numbers of such engines were built for British railways during the next 25 years or so.

Among the locomotive chiefs who were attracted by the engine was L. B. Billinton, of the London Brighton and South Coast Railway. He was contemplating the introduction of some engines to cope particularly with the fast Continental freight trains between London and Newhaven; their loads were rapidly becoming more than the existing goods engines could manage successfully.

Billinton saw in the new GWR engines exactly the sort of thing he needed, and he set to work on the preparation of the design for his 2-6-0 engines of Class K; meanwhile his choice was fully vindicated by the excellent results that were obtained, not only from the GWR engines, but also from ten 2-6-0 fast freight engines that H. N. Gresley put into service on the Great Northern Railway in 1912.

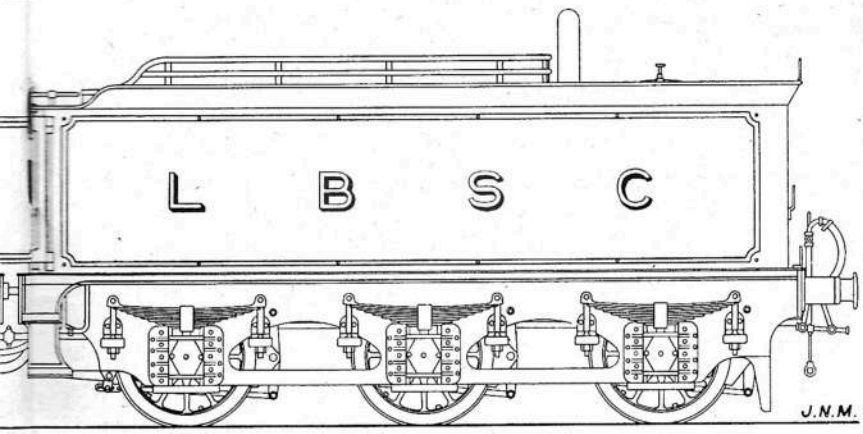
The first Brighton example of this type was No 337, which was put into traffic in September 1913. She was followed by No 338 in December of the same year, and by 339 in March, 340 in July, and 341 in November of 1914, the last taking the road some two months after the 1914-18 war had broken out. The engines proved to be so successful that special permission was obtained from the Government for the construction of some more of the same class, with the result that another five, numbered 342 to 346, were added to the class between October and December 1916.

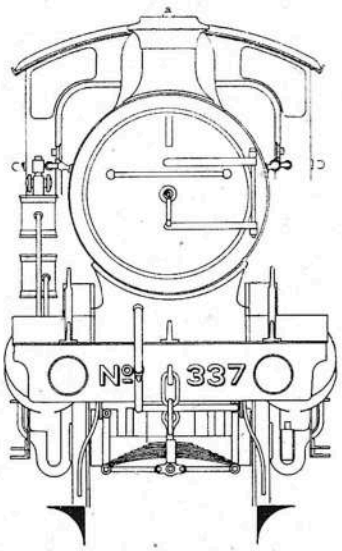
These ten proved to be invaluable on war work, for they were capable of hauling trains of munitions and other military equipment weighing up to 1,000 tons or more at speeds of 35-40 m.p.h.; moreover, they were unusually economical in fuel consumption, and their ability to accelerate rapidly from a standstill was especially remarkable.

After the war, and with the return of something approaching normal peacetime conditions, the engines proved themselves thoroughly efficient on fast passenger trains; so much so that another four, Nos 347 to 350, were built in 1920, to be followed by a further three, Nos 351 to 353, in 1921.

After the grouping of railways in 1922, all 17 of Class K were taken into Southern Railway stock. They made themselves thoroughly useful to their new owners.

To widen the scope of their operations, R. E. L. Maunsell lowered the chimney height, flattened the top of the dome, and radiused the cab roof into the top of the cabsides, so as to clear the minimum loading gauge of the Southern Railway; but so far as I know, Class K was seldom seen far outside what had formerly been the LBSCR system, except at Salis-





E there is a poignancy in this
ASKELYNE did not live to finish

RIGHTON

MOGULS

bury, on the through trains from Brighton to South Wales. On heavy extra trains to the south-coast resorts at holiday times and week-ends, the engines were particularly useful; at such times, I noted as many as 12, out of the 17 engaged on such work, in the course of not more than six hours' observation.

The Ks were the most powerful engines on the Brighton Railway, in practice as well as in theory. Their leading wheels were 3 ft 6 in. dia., the coupled 5 ft 6 in., and the tender 3 ft 9 in. The wheelbase of the engine was 23 ft 9 in., divided into 8 ft 3 in. plus 8 ft plus 7 ft 9 in.; that of the tender was 13 ft equally divided, and the total for engine and tender was 47 ft 11 in. At the front, the overhang of the engine was 2 ft 6½ in., and at the back 5 ft 9 in.; for the tender, the overhang was 4 ft 9 in. at the front and 3 ft 9 in. at the back. Over the bufferheads, the total length was 57 ft 10 in.

The cylinders were large, with a diameter of 21 in. and a stroke of 26 in.; they had 10 in. piston valves actuated by Stephenson link motion with the weighshaft above and the expansion links suspended on the centre-line of drive. The link pins were 1 ft 6 in. apart on the curved centre-line of the link.

I have based my drawing on the working drawings published in *The Engineer* for January 30, 1914, from which it is clear that certain modifications were decided upon during construction. For example, the drawings show, in elevation and plan, a large sandbox incorporated in the leading splasher, but the engines did not have this; and the drawings show no forward extension of the piston-rods, whereas the engines were provided with it.

The boiler was pitched 8 ft 6 in. from rail level; the barrel was made in two rings, 5 ft 1¾ in. and 5 ft 3 in. dia. outside. There were 110 tubes of 2¼ in. dia. and 21 of 5½ in. dia., their combined heating surface being 1,155 sq. ft. The superheater tubes were 1½ in. dia., outside. They had a heating surface of 279 sq. ft.

It was on these engines that the Belpaire firebox was first introduced on the Brighton Railway. Its outer casing was 8 ft long, and the inner one 7 ft 4½ in.; the width, inside, was 3 ft 4$\frac{11}{16}$ in. at the grate, and the heating surface was 139 sq. ft, while the grate area was 24.8 sq. ft.

The tender was of quite a new design for the Brighton; it had outside slotted frames and its capacity was for 3,940 gallons of water and four tons of coal. It was provided with a tall steam dome where some of the exhaust steam from the engine was led into a pipe that reached almost to the top of the dome, inside, and allowed the steam to flow down outside the pipe to spread over the surface of the water in the tanks, and so heat the water for feeding the boiler, as in Stroudley's system.

In working order, the engine weighed 63 tons 15 cwt, of which no less than 55 tons 5 cwt was available for adhesion. The tender weighed 41 tons 10 cwt, making the total 105 tons 5 cwt.

In 1916, Billinton introduced his system of top-feed for the boilers. It had two distinct arrangements. The first consisted of mounting the clacks on top of a manhole about 3 ft ahead of the dome; the second consisted of providing a second dome mounted on the boiler barrel, exactly on the vertical centre-line through the leading coupled wheels, with the clacks placed high up on its back. Engines 342 to 346 were built with the first arrangement, and 337, 338, 340 and 341 were fitted with it later. No 339 was given the second arrangement in February, 1920, and 347 to 353 had it when they were built later in that year.

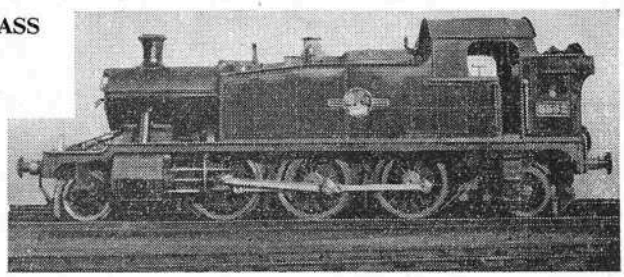
They passed into the ownership of British Railways in 1948.

The class Ks are still in service and have recently undergone maior overhauls.—EDITOR. ▣

FIREFLY

Cotninued from April 6 1961, pages 418, 419 and 420

A GWR 2-6-2 TANK ENGINE OF THE 45XX CLASS



Work on the 5 in. and 4$\frac{1}{16}$ in. gauge models proceeds from crankpins and eccentrics to coupling rods, connecting rods and brake gear

By MARTIN EVANS

WORKING to the larger scale of 1$\frac{1}{16}$ in. to the foot enables us to make the coupling and connecting rods almost to scale, at least as far as the side elevation is concerned.

It is always advisable to add a little extra thickness to prevent any chance of whipping in running fast. Churchward had trouble with coupling rod whip when his four-cylinder *North Star* first ran her trials. Owing to the divided drive, stresses in the coupling rods were more severe than in his two-cylinder engines, and the deeply-fluted rods first fitted were apt to take on a permanent set. Heavier non-fluted rods cured the trouble. They have been used ever since on GWR four-cylinder locomotives, and on the two-cylinder engines as well.

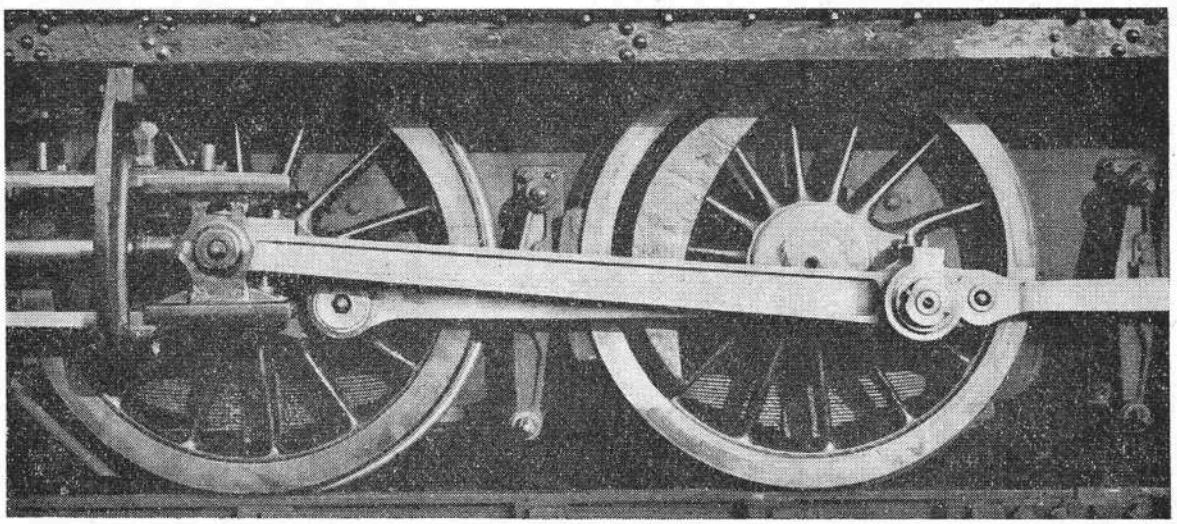
I have seen it suggested that this type of coupling rod is responsible for some limitation of maximum speed with GWR engines. It is certainly true that no GWR engine has ever approached the very high speeds achieved by the LNER A4s or the later LMS Pacifics, but I am not at all sure that one of the latest Castles could not do the same as *Mallard* in similar conditions down the Stoke Bank. The highest speeds achieved on the GWR have, I believe, been reached at the bottom of the Severn Tunnel and on the Worcester line, and neither stretch gives quite the same opportunity as the Stoke Bank for reaching a very high speed.

The crankpins, which follow those of the 3$\frac{1}{2}$ in. gauge very closely, are all machined from $\frac{7}{16}$ in. dia. silver-steel. As in the smaller engine, the leading crankpins are considerably shorter to provide clearance for crossheads and slide bars. The eccentrics are turned from 1$\frac{3}{4}$ in. dia. mild steel, and it will be advisable to support the bar with the tailstock to eliminate any danger of chatter in turning this large diameter.

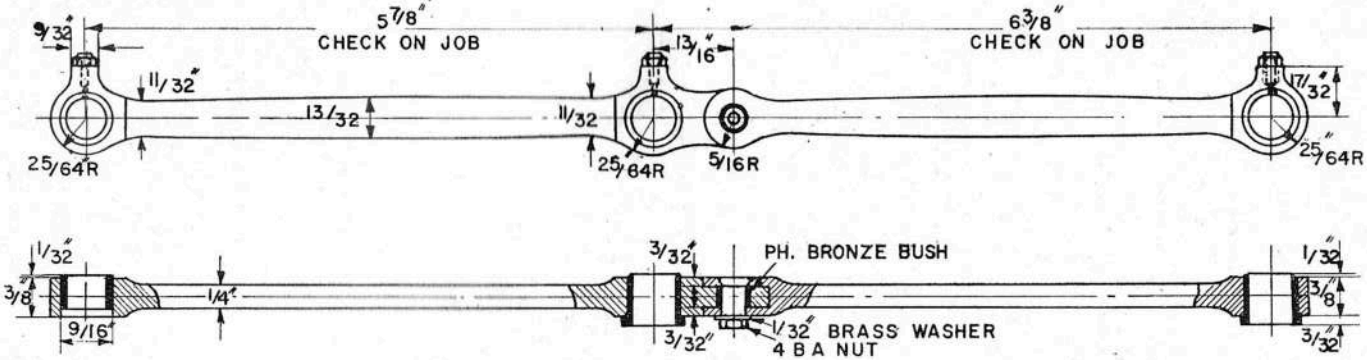
The eccentrics are held in the axle with 2 BA Allen grub screws. There is no need to fit the screws until the valve gear has been made and erected.

The quartering of the driving and coupled wheels is now carried out, the axleboxes and eccentrics having been put in position beforehand. When this has been successfully accomplished, the wheels are pinned with short lengths of $\frac{1}{8}$ in. dia. silver-steel pressed in, half in the wheel and half in the axle.

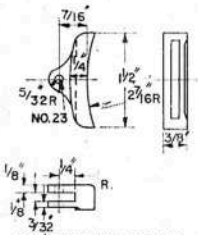
While the coupling rods are very



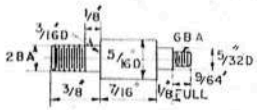
Connecting rod of GWR 4500 Class



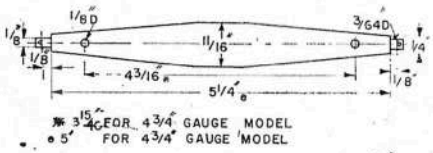
COUPLING ROD 1 PAIR BMS LH DRAWN



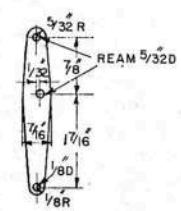
LOCOMOTIVE BRAKE BLOCK 6 OFF BMS OR CI



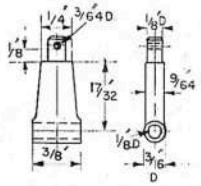
BRAKE HANGER PIN 6 OFF SILVER STEEL



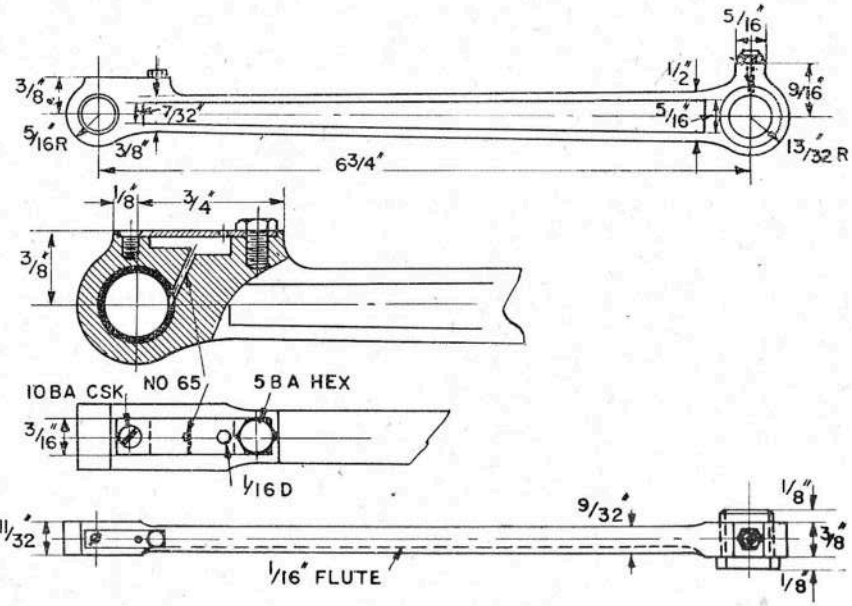
LEADING & DRIVING BRAKE BEAM 2 OFF 1/8 BMS



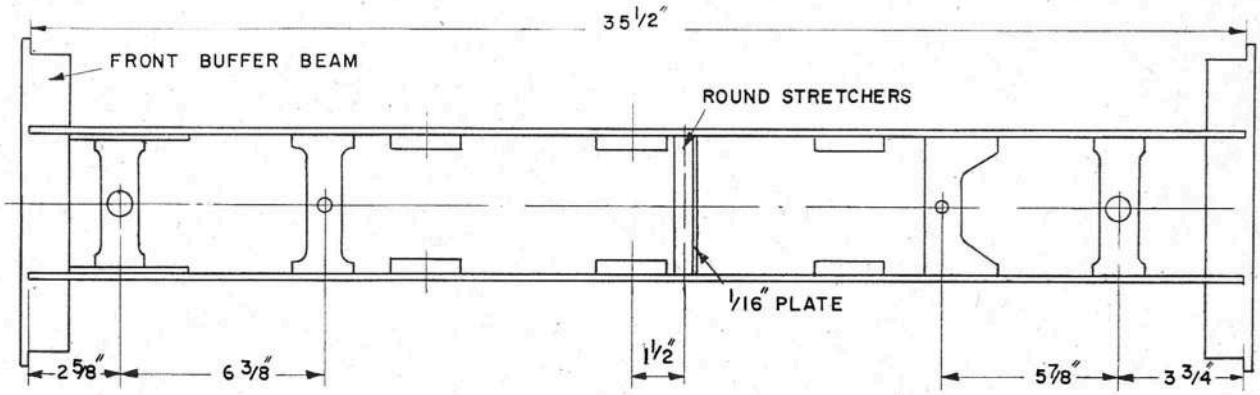
LOCOMOTIVE BRAKE HANGER 6 OFF 1/8 BMS



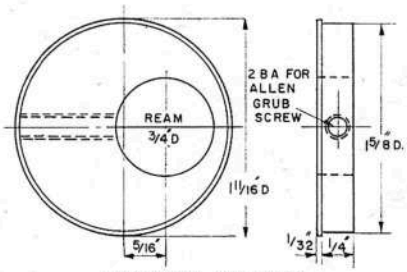
BRACKET FOR TRAILING BRAKE HANGER 2 OFF BMS



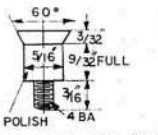
CONNECTING ROD 1PR BMS LH DRAWN



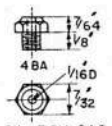
PLAN OF MAINFRAMES SHOWING POSITIONS OF STRETCHERS



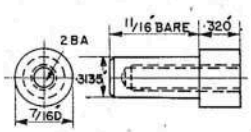
ECCENTRIC FOR VALVE GEAR 4 OFF BMS



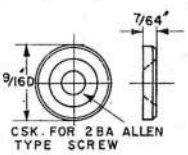
PIN FOR INTERMED JOINT 2 OFF BMS C HARDEN

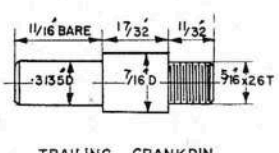


OIL BOX CAP 6 OFF BRASS

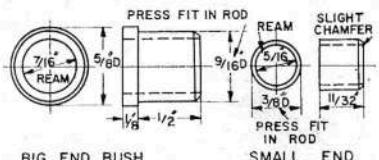


LEADING CRANKPIN 2 OFF SILVER STEEL





TRAILING CRANKPIN 2 OFF SILVER STEEL

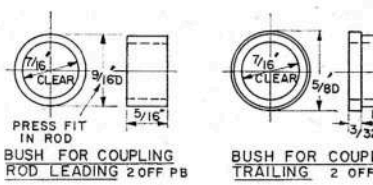


BIG END BUSH 2 OFF PH BRONZE

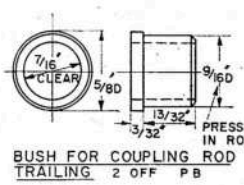
SMALL END BUSH 2 OFF PH. BRONZE

similar to those for the 3½ in. gauge engine, they are slightly closer to scale. They are made from 1 in. × ⅜ in. mild steel. As I mentioned in my last article, it is a good plan to finish the intermediate joint before drilling for the trailing bush. All the bushes are turned from drawn phosphor bronze rod—⅝ in. dia. for the main bushes and 7/16 in. dia. for the intermediate joint.

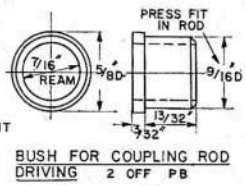
My drawings of the connecting rods show a properly shaped oil box for the small end. As there is enough room in the crosshead, this would make a nice finish to the rod. The oil recess is end-milled out by a 3/32 in. slot-drill, while the 1/32 in. deep recess for the cover plate can be milled out with a small diameter face cutter of 3/16 in. thickness so as to obtain the square corners. The cover plate, which is made of steel 1/32 in. thick, is held down by a 10 BA countersunk screw at the front end and a 5 BA hexagon head screw at the rear.



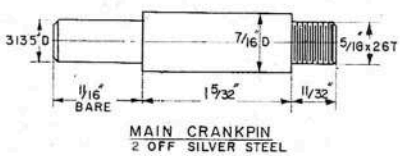
BUSH FOR COUPLING ROD LEADING 2 OFF PB



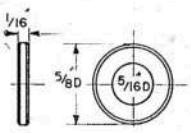
BUSH FOR COUPLING ROD TRAILING 2 OFF PB



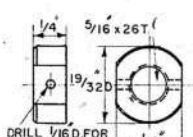
BUSH FOR COUPLING ROD DRIVING 2 OFF PB



MAIN CRANKPIN 2 OFF SILVER STEEL



WASHER FOR CRANKPIN 4 OFF BMS



NUT 4 OFF BMS

The phosphor-bronze small-end bush is made a tight press fit in the rod. It may, with advantage, be a few thou longer than the thickness of the rod at this point. Put the reamer through the bush afterwards, in case of compression.

Brakes

I propose to describe a complete steam and hand brake arrangement for the larger engine. The brake cylinder is inside the frames above the rear pony truck, and the hand brake column is outside the frames

● *Continued on page 496*

SS CANBERRA MODEL COMPETITION

This is a great new competition for ship modellers—jointly sponsored by the P & O Steam Navigation Co. Ltd. and MODEL ENGINEER. Silver cups are to be awarded for what are judged to be the best models of the new P & O liner, s.s. CANBERRA, which will be sailing on her maiden voyage this year.

In conjunction with the competition there is a series of articles describing how to build the Canberra—either a hull or waterline model. The first article was on August 25 and fortnightly instalments continued until January 26.

The handsome silver cups, one for each of the three sections in the competition, will be presented by the P & O and medals for craftsmanship will also be given.

Two of the three classes are for boys—the first for youngsters under 15 and the second for boys who have reached 15 but are under 18. The third class is open to all ages and will no doubt appeal to many experienced and expert ship modellers.

Joint efforts are allowed but where groups of boys build a model, the age of the oldest boy must be the determining factor as to which class is entered.

The latest date for the submission of completed entry forms is: 30 June 1961. Models must be completed by 31 July 1961.

It is intended that prize-winning models will be on show at the next MODEL ENGINEER National Models Exhibition. In any event there will be a display of some of the entries but details will be announced later.

Entry forms should be sent to the MODEL ENGINEER, 19-20 Noel Street, London, W1. Details of where the models should be sent will be notified direct to competitors nearer the closing date.

Any scale may be used to build the model and no limitations are made on the type which should be entered. The choice of materials is entirely up to the builder.

The series of special articles, written by Mr Edward Bowness, describes the liner, how to build at least two different types of model, and discusses the problems generally. The ME Queries Department will be prepared to answer questions from entrants provided that letters comply with the Query Service rules of MODEL ENGINEER. These are printed in each issue of the magazine.

CONDITIONS OF ENTRY

1. The Competition is for a model of the P & O liner s.s. CANBERRA, a plan of which was issued with MODEL ENGINEER of 25 August 1960, and is organised by Percival Marshall and Co. Ltd.
2. There will be three classes:
   A—Aged under 15 on 31 July 1961.
   B—Aged under 18 on 31 July 1961.
   C—Aged 18 and over.
3. Any scale may be used. A waterline model is eligible. Materials are at the discretion of the competitor but their suitability may be borne in mind by the judges.
4. The closing date for the competition is 31 July 1961 and the latest time for the receipt of completed entry forms is 30 June 1961.
5. Models must be sent to an address in London by a date, probably in early August 1961, which will be notified direct to the competitor. While in transit the models are the responsibility of the competitor and Percival Marshall and Co. Ltd. accept no responsibility for them. The prize-winning models and some of the entries will be placed on show at the discretion of the organisers, before being returned to competitors.
6. A joint or co-operative effort in model making will be allowed in the competition, although this fact must be clearly shown on the entry form and may be taken into consideration by the judges. Where co-operative efforts are entered, the age of the oldest model maker taking part must be used in determining in which class the model should be entered.
7. Expert judges will be appointed by the Editor of MODEL ENGINEER. Their decision shall be final.
8. A silver cup for each class is to be given by the P & O and medals for workmanship will be awarded by Percival Marshall and Co. Ltd. The awards will be at the discretion of the judges and they may not be made if the entries are not up to the standards expected.

ENTRY FORM

Name.....

.....

Address.....

.....

.....

Date of birth if entered in classes A or B.....

.....

Class entered.....

Scale of model.....

Length of model in inches.....

State here if any parts of the model were purchased. and if so, what they were:

.....

.....

.....

.....

If the model was produced in collaboration with other modeller(s), give details:

.....

.....

.....

.....

Details of equipment and tools used:

.....

.....

.....

.....

Please give the names of two local or provincial newspapers in your locality:

.....

.....

I certify that the model is my own work, other than as stated above, and that I will abide by the conditions.

Signed.....

Date.....

Send this form to Model Engineer, 19-20 Noel Street, London W1. Details of where the model is to be sent will be sent direct to competitors.

CLOSING DATE FOR ENTRY FORMS: 30 June 1961.

Models to be completed by 31 July 1961

A MIXED BAG

Boiler joints

As I am more familiar with marine boilers than with locomotive ones, I have been waiting for a reader abler than myself to answer Martin Evans' invitation to comment on the strength of *Jubilee's* boiler [Foot-plate Topics; December 22].

To determine the total load on a circumferential joint of the boiler, Martin Evans takes the smokebox tubeplate area exposed to pressure and *adds to it*, the similarly affected area of the backhead, before multiplying by the pressure. I disagree with this; as we do not have to consider *two* loads acting in opposite directions. The total load on the joint is found by multiplying the pressure-affected area of *one* end by the pressure. Where the ends are of unequal area, the relative position of the joint and the shape of the boiler will determine the area figure to be used.

Let us imagine a free, unstayed, cylindrical vessel of negligible weight, with closed ends and a circumferential joint. We can put the joint under tension by external means, instead of by internal pressure. If one end-plate is secured to a fixed point and a pull of x lb. is exerted at the other end, the total load on the joint is x lb.

If a spring balance is now interposed in the attachment at the fixed end and the same pull is exerted as before, the spring balance will record x lb. pull, and again this will be the load on the joint. The load is not increased to $2x$ lb., which is the sum of the opposing forces at each end.

It may be of interest to demonstrate that the stress on a longitudinal joint, in an unstayed cylindrical pressure vessel, is *twice* the stress on a circumferential joint. Consider the thin shell vessel, with closed ends, in Figs. 1 and 2, where the stress over the material is constant. Let D be the diameter, in inches. L the length, t the shell thickness, and P the pressure (p.s.i.).

The value for longitudinal load, $P \times D \times L$, is an approximation for the rather complicated radially acting pressure load, but it has been found to be sufficiently accurate for practical purposes.

Assuming 100 per cent. efficiency of joints, to simplify the determination of the area resisting failure:

Stress on longitudinal joint = $\frac{Load}{Area} = \frac{LDP}{2tl} = \frac{DP}{2t}$ *lb./in.²* (*Fig.* 1)

Stress on circumferential joint = $\frac{Load}{Area} = \frac{\frac{\pi D^2}{4} P}{\pi Dt} = \frac{DP}{4t}$ *lb./in.²* (*Fig.* 2)

Therefore longitudinal stress is *twice* circumferential stress.

It can be seen that, provided the end plates are of suitable thickness and are staved or shaped to prevent distortion, the weakest section of the usual type of cylindrical pressure vessel will be in its longitudinal plane. It is therefore prudent to base design

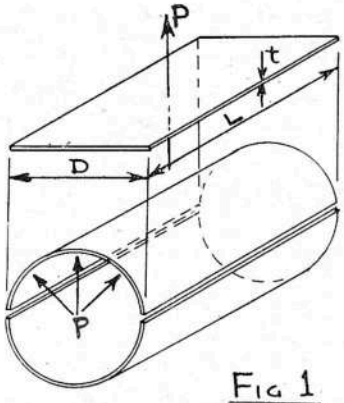


FIG 1

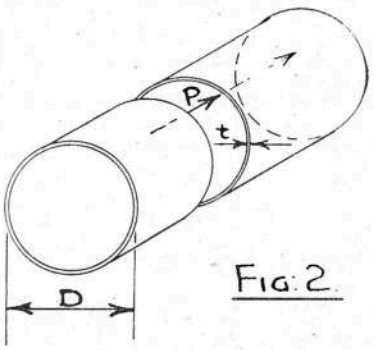


FIG 2

calculations on this fact. With a boiler whose circumferential and longitudinal joints are of equal efficiency, the permissible internal pressure will be governed by the strength of the longitudinal joint. In a boiler with no joint longitudinally, the circumferential joint, provided that its efficiency is more than 50 per cent., is stronger than the boiler shell on a longitudinal plane.

The strength of the shell depends on its thickness (and on the efficiency of longitudinal joint, if one is fitted), and not on its length. Again, the essential purpose of longitudinal stays and stay tubes is to prevent distortion of the flat surfaces of the end-plates. The stays will not be called upon to help in preventing circumferential failure of the shell, unless the joint efficiencies are so exceptionally low that in any event, the boiler must be regarded as unsafe. ▣

Steam tests in Pennsylvania

MODEL locomotive enthusiasts in this country who operate on live steam tracks will be interested in the boiler inspection and testing procedure adopted by the Pennsylvania Live Steamers.

Martin Evans thinks that the system is reasonably good but suggests that a more thorough test would be to make the hydraulic test up to one and three quarter times the working pressure and to introduce a test under steam.

Applicants for the certificate could also be asked to state whether the boiler was riveted and soft soldered, or brazed and silver soldered; what was the type, size and spacing of the stays; and whether the engine was superheated or not.

The procedure was put into use by the Pennsylvania Live Steamers in 1957 and was finally accepted by them in March last year. It has also proved acceptable to visitors who run their engines on the railroad, and the PLS are asking other clubs to study it so that, if it is generally approved, all the clubs in America and Canada will have a common standard, convenient for everyone.

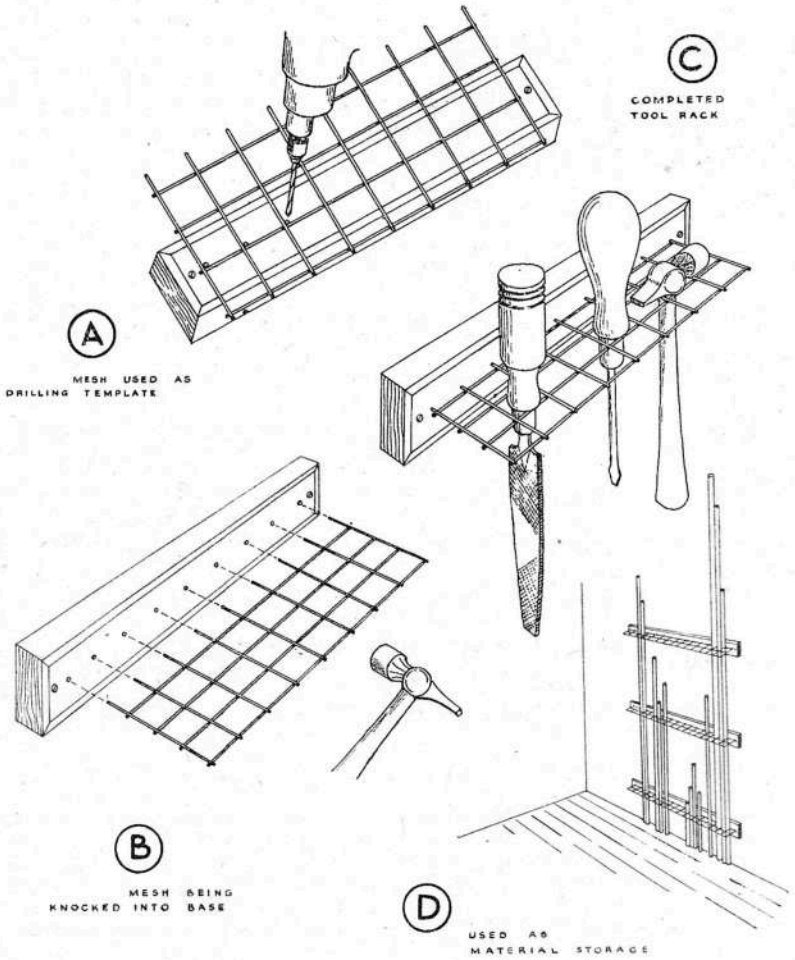
Carl R. Dougherty, chairman of the Executive Committee (2525, Rosemont Avenue, Ardmore, Pennsylvania) says that he will be glad to revise the procedure in accord with majority opinion and to submit it again for acceptance. His invitation may be summed up as: "Do you approve or not? If you would like any changes to be made, please let me know as soon as possible."

Here is the procedure:

This procedure to establish and enforce yearly inspection and testing was put into use by the Pennsylvania Live Steamers in 1957 and was finally adopted by them last year.

1. Appoint a minimum of three boiler inspectors responsible for testing boilers and recording.

2. All locomotives shall be subjected to a hydrostatic test to a minimum of 1½ times regular working pressure once a vear.
3. The test may be performed by the owner or operator of the engine, and the test must be witnessed by an inspector. The owner or operator, if he desires, may be assisted by an inspector to prepare the boiler and administer the test; however, full responsibility of test shall be that of the owner or operator.
4. Upon completion of the hydraulic test, inspector shall partly fill in the white and yellow boiler inspection Certificate pertaining to hydrostatic test.
5. After steam is raised, and before the engine moves from the siding, the owner shall cause the safety valves to operate (by steam pressure, not manually) and show that valves are adjusted and functioning properly.
6. Upon completion of safety valve test, the inspector shall complete the certificate and furnish the yellow copy to the engine owner. The white copy shall be retained by the recording secretary and made available to inspectors at track on all scheduled steam meets or running days for reference.
7. The boiler inspection certificate shall remain valid for a period of one year from date of issue.
8. This procedure and testing requirement shall apply to all locomotives run on PLS facilities by members, guests and visitors.
9. If an owner, for any reason, refuses to submit his locomotive to hydrostatic and safety valve test, he shall not be permitted to fire-up or run the engine.
10. Engine owners shall be liable to show valid Boiler Inspection Certificate or proof of test at any time, on demand of an inspector, or submit to a re-test.
11. Boiler inspectors shall be appointed by membership and shall have full responsibility and authority in all matters pertaining to boiler inspections, testing and regulations as set forth.
12. Each club shall provide a test pump with pressure gauge, mounted on a base, connecting tubing, and an assortment of American and British plugs and fittings to assist members and visitors in testing boilers.
13. This procedure and certificate format should, if accepted by PLS membership, be presented to all Live Steam Clubs in an effort to obtain national acceptance of this plan and, of course, promote its reciprocal usage. ▣



Racks for tidiness

I BELIEVE most readers will agree that the orderly arrangement of tools and materials in the workshop not only saves the time spent in hunting for a piece of material or a tool, but also gives an appearance of "good housekeeping."

In my own instance, the storage of odd lengths of rod, bar and tube has up to now left much to be desired. After going through the phases of standing them in an odd corner (they always stick out eventually), laying them in a horizontal rack (where the bottom one is always the one you want), and tying them in bundles that always become loose, I feel that I may lighten the lot of my fellow-sufferers by sharing my method with them.

Having an odd piece of Weldmesh left over from a leg-guard, which I was making for one of my passenger trucks, I hit upon the idea of using it to make a material rack. Naturally I wanted to make it in the quickest and easiest way.

My illustration needs little comment. The making is simple and the rack can be built to any dimensions and put to many other uses which will readily come to mind.

I used 1 in. × 1 in. mesh for the tool rack and 2 in. × 2 in. mesh for the material rack, and chose a drill the same size as the gauge. As Weldmesh is obtainable from ½ in. sq. upwards, in oblong, and various gauges, it gives a wide choice of racking.

The material is a product of the BRC Engineering Co. Ltd. I cannot but admire its rigidity and uniformity—hence my application of jig drilling. ▣

Continued from 23 March 1961, pages 368 and 369

BLACK SAND

COOKING KIPPERS WITH THE DEVIL

By GEORGE W. EVES

WITH sheet lead, Charles built up the worn bearings. Seated on the end of an up-turned sieve, I watched the mould being made. The bearings were set on a turnover board, fine burnt sand was applied, the bearings were covered with fine sieved sand, and the box was filled up and rammed very firm.

When the whole was turned over and the board removed, I saw the bearings firmly embedded. It was jointed in such a way that the top box would lift off. Then the top box was put on, held perfectly in position by three pins. A piece of 3 in. round wood was stuck vertically in the joint, fine sand was used to cover the patterns, and the box was filled and rammed exactly like the bottom half, and finally levelled off. The wooden upright was now withdrawn. This was where the molten brass would go down later in the day.

"Now," said Charles as he stood astride the box, "this has to be lifted perfectly level if you want a perfect lift." Up came the box, to be turned back on an empty box mould upwards. Charles finished off the top first. The rough marks, scours and poor machining, he soon made good. He then turned to the bottom half. The bearings were wetted round with the water brush and a peg in the oil hole was rapped to give a good clearance round the bearing. A wooden peg drove tight into the oil hole and with it a masterly hand withdrew the bearing.

When the lead lining had been reclaimed, the mould looked a mess. With deft movements, Charles built up the wear, squared the sides, cut away where necessary for machining and, in short, carved the bearing from the mere beginnings which the pattern had left. It might well have been the mould from a brand new wooden pattern.

Ample runners were then cut from the vertical pourer into each bearing. Under a watchful eye, I mixed the chalk and water paste. Charles applied it. The hand bellows chased out the bits and unwanted dust, and Charles carried the top and bottom boxes into the oven to dry.

Under Charles' instruction, I laid the bottom of the fire and saw that it was good and deep. The 14 lb. crucible was filled with gunmetal scrap and firmed down on the fire bottom. While I operated the bellows handle with long vertical strokes, Charles built up a huge mound of wet coal about it. Two lumps of hard coke covered the mouth of the cricible. The long blow was left to me. For a solid hour I pumped that handle up and down. I changed hands every minute. The fire crept up round the crucible, whose top was glowing hot. Man-sized sparks fanned out all round, and to escape them, I stood round the corner, my arms aching.

Meanwhile the dry mould had been brought from the oven and assembled close behind the forge. The top box was replaced and a pouring cup was fixed to the vertical hole or gate. Four weights placed at correct stations held the two boxes firmly together.

Preparing to pour

As the metal melted, Charles pushed more scrap in between the white hot coke into the crucible, until the pot was full. The skimmer was laid over the fire to warm. Through the gap in the coke, Charles frequently stirred the contents of the pot with a thin iron rod, already warmed. At last, the metal was ready.

The flaming mass about the pot was shovelled away, until the pot stood white hot and glowing. The heat was terrific. Charles seized the crucible in a large pair of tongs and lifted it clear and then down on to the floor. Another moulder quickly skimmed off the dross floating on top of the metal, stirred it in case any floated below the surface, and then skimmed again. The crucible was quickly transferred to a bale and borne off to the mould. After a final skim, the pot was poised over the pouring cup and tipped. Flames spouted from the metal, now flowing like water. As the mould filled, the flame and fume took on rich blue and green tints. The mould held all but about half a pint of metal, which was poured carefully on to the dry floor.

Half an hour later Charles knocked out the mould and with a set of tongs lifted the still hot bearings from the boiling sand about it. I saw a perfect pair of castings still attached to the solid runners. We took them into the trimming shop where brisk wire brushing made them shine like gold. There we left them to cool off.

That was my first introduction to brassing. It was an emergency cast with forced draught, which is not so economical as the natural draught furnace to which I was introduced later.

I went home full of brassing, ready to enthrall the family at tea-time, but my father was in high dudgeon as that afternoon the military had boldly entered a nearby field, removed the gate and dragged in a searchlight, with an oil engine and dynamo to supply it. "I don't know what this country is coming to," he fumed. "Nothing is sacred these days. It's time we had a different government" . . . Times haven't changed much, have they?

The bomb craters from the Zeppelin were the pride of the next village. The farmer in whose orchards they had fallen was on the gate with a collecting box for the local hospital. He did well. Folk stood beside the craters in silence. Three of them would not have hidden a wheelbarrow, but the other two were 20 ft across and nearly as deep.

On Monday core making began with urgency. There was a great deal of satisfaction in the foundry because for once we had some decent patterns. We carried much into the oven, and by nightfall there was far more on the shelves than ever before. Nor did we let up for the next two days. The Zeppelins were forgotten. Instead Charles got me mixed up in that

evergreen debate on whether a train guard armed with a rifle, whose bullet rate of travel was the same as the speed of the train, could hit the driver when going round a bend. By mid-afternoon we were drawing diagrams on the sand floor.

Next day I was put on making cores for skid pans. They were a simple round effort, 5 in. long and $\frac{5}{8}$ in. dia. Charles said that as the days were getting a bit chilly and our's was a draughty spot, we might as well have the "devil" in. This turned out to be a big brazier standing on three legs such as is used by night-watchmen on roadworks. Lighting it up filled the place with smoke. "Nice warm smoke," said Charles, "is better than that East wind outside." But in good time, I had a coke fire so hot that you could not get near it. I was shown how to put the skid-pan cores on a plate across the top of the fire.

When the plate was as hot as the coke underneath, my mate poked a wire in the vent hole, and quickly immersed the core into a pot of Stockholm tar. It fizzed and gave off acrid white smoke, and when it was returned to the hot plate it burnt merrily for 10 minutes.

Soon I was lifting the cores, dipping them and watching them burn. When the last flame had flickered away, the plate was lifted off and placed on a shelf to cool off. They were then hard as concrete. Skid-pan cores were the only ones thus treated, and this enabled them to be put in as the moulder went along, and not a few hours before castings, as is correct practice with other cores. The area round the tarred core becomes glass-hard, all right for bolt holes but useless for castings that have to be machined.

The devil performed many duties. Its warmth was pleasant to your rear as you worked with cold, damp sand. Forbidden pipes were surreptitiously lit by fleeting figures. A bucket of water could be boiled in a few minutes. At lunch-time men put their bread and cheese underneath on a shovel, and the result was a Welsh rarebit. Charles cooked kippers and bacon in his polished shovel. To me it was a great boon, for a core never sticks in a warm corebox. Charles' quiet enthusiasm for his job was catching and in good time I could ram a pretty good core.

Casting day came round very quickly, and I found it exhausting. I was wad boy, skimmer, chain hand on the travelling crane, and weight-shifter. No sooner had I carefully put twenty or thirty half-hundred weights on a mould, than its mate in the next row, having been poured from the previous pot, was ready to be relieved of its burden.

Luckily there was little feeding to do. Not a grain of dross evaded my skimmer, each riser was eased at precisely the right moment, and all vents were lighted promptly.

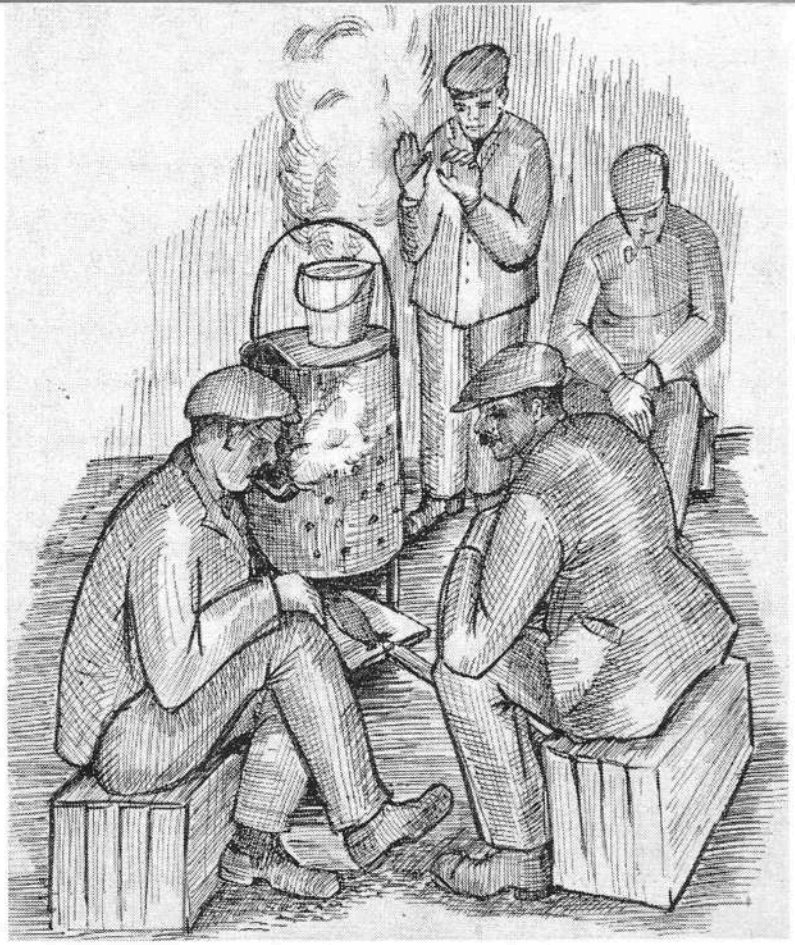
I moved exhausted in a world of steam, heat, glare, and that continuous cry: "Wads up, George." Nobody was more thankful than I when the last pot had been poured, and the remainder tipped into a trench dug in the sand. Sweat poured off the men as they rested in the trimming shop afterwards, and because I showed little signs of perspiring I was deemed not to have been made right.

Getting the castings out had a new sense of urgency on the following day. The moulders made frequent visits to the trimming shop to see the lathe parts. There were discussions over the runners and placing of the risers.

Charles and I, fully occupied with sand for the next batch of cores, were on the fringe of all this activity.

When the foundry foreman arrived with a list of what was wanted, Charles leaned professionally on the up-ended sieve, and I overheard the conversation drift from cores to rabbits and to the extra ha'penny on beer. Had not the cry of: "Tally-ho" gone forth, there was no telling where it would have ended.

★ *To be continued*



ME BEAM ENGINE ARTICLES

This list is printed at the request of severa readers who have asked for the dates of the ME Beam Engine articles.

1959

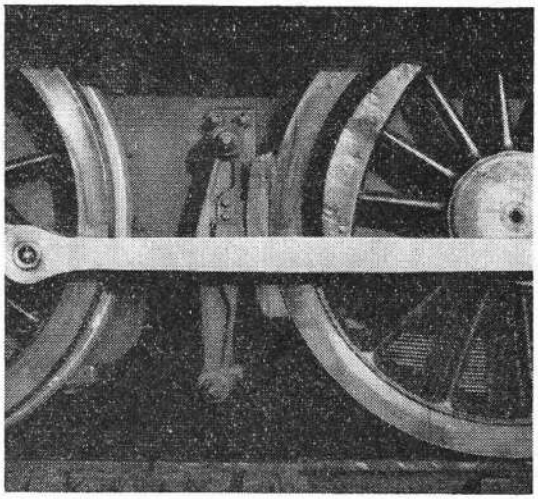
Oct. 1—
,, 8—Plinth and main bedplate.
,, 15—Machining column and beam.
,, 22—Cylinder casting.
,, 29—Machining cylinder cover and steam chest.
Nov. 5—Further machining of main working parts.
,, 12—Machining main working parts.
,, 19—Machining the bearings.
Dec. 3—Machining the valve gear and bearings.
,, 10—Valve gear details.
,, 17—How correct is the "conventional method"?

1960

Feb. 25—Mechanics of the parallel motion.
Mar. 3—Governor gear, design and construction.
,, 10—Constructing the column bracket.
,, 17—Machining governor column.
,, 24—Governor linkage.
,, 31—Other ways of machining the arms and governor details.
Apr. 7—Fork lever bracket and details of control gear.
,, 14—Machining the steam valve body stopcock and throttle valve.
,, 21—Feed pump construction.
,, 28—Fabricating the feed pump.
May 5—Further feed pump details.
,, 12—Final details and assembly of feed pump.
,, 19—Transmission gearing.
,, 26—Gearing specifications and final details.

on the right-hand side of the locomotive.

The trouble with steam brakes in the smaller scales is that, unless the cylinder is made very small, the brake blocks hold the wheels so firmly that the wheels lock and just slide along the track, with consequences which on steel rails can be disastrous. Even if it is not possible to use the steam brake for pulling up the train, the unit is interesting to build.



Brake block and hanger on 5562 —a later engine

Brake blocks

Make a start on the brake blocks, which are cut from $1\frac{1}{2}$ in. $\times$ $\frac{3}{8}$ in. bright mild steel. The end of the bar is first faced, the No 23 hole drilled, and the bar clamped on edge under the tool-holder.

A large diameter slotting cutter $\frac{1}{8}$ in. thick is then mounted between centres and the slot to take the hanger is milled out. The block is sawn off and the operation is repeated for the other five blocks. The curved side which bears against the wheel and the back are then hand-filed.

Another method is to set up a fly-cutter in the lathe between centres, to cut a $2\frac{7}{16}$ in. radius, and to mount the bar on edge. Cut away the radius and saw off from the bar the required amount; drill the No 23 hole, clamp sideways under the tool-holder, and use an $\frac{1}{8}$ in. end-mill in the chuck to form the slot.

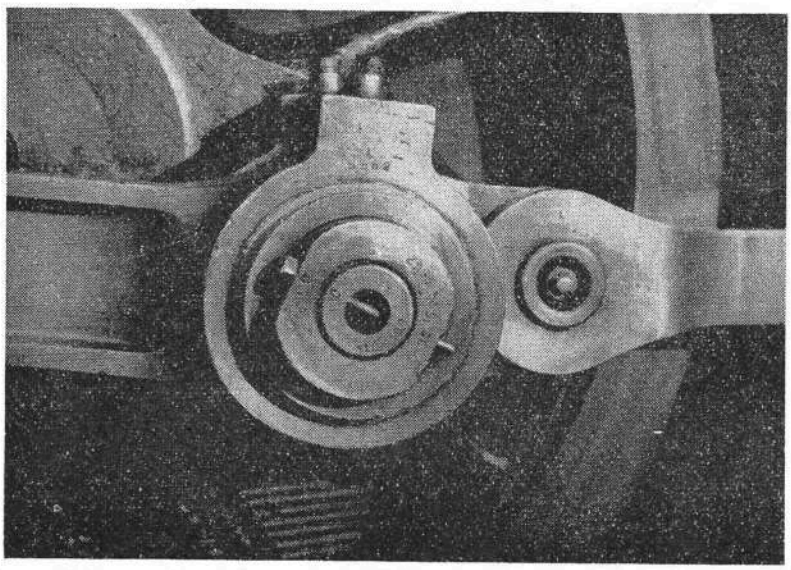
You can make the brake hanger pins next. They are turned from $\frac{5}{16}$ in. dia. round silver-steel. Turn the $\frac{3}{16}$ in. dia. first, and thread it $\frac{1}{4}$ in. long, leaving $\frac{1}{8}$ in. of the full diameter. Reverse, holding the pin lightly in the chuck, and turn down the other end to 5/32 in. dia. Then reduce to 0.110 in. dia. for a length of 9/64 in. and thread this part 6 BA.

The hangers, which are very simple, are cut from $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in. BMS, while the brake beams are cut from a $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in. strip of the same material. There are only two full-length brake beams, as my intention is to attach the trailing hangers to the pull rods by short brackets which can be silver-soldered to the pull rods direct. The pull rods themselves lie immediately underneath the bottom edges of the mainframes; they come between the backs of the driving and coupled wheels and the spring pins of the axleboxes.

This method allows the full width between the frames for withdrawal of the grate and ashpan, a great boon for those who run their locomotives frequently.

The brackets can be quickly made from $\frac{3}{8}$ in. $\times$ $\frac{3}{16}$ in. bright mild steel. Cut off two lengths $\frac{7}{8}$ in. long, drill the $\frac{1}{8}$ in. dia. hole right through the end, put in the four-jaw chuck, and turn the $\frac{1}{8}$ in. dia. end which passes through the brake hanger. The remainder can be hand-filed.

The cross-drilled 3/64 in. dia. hole is to take a steel split-pin, which is slipped through after assembly. Do not fix the brackets to the pull rods until the cross-shaft and cranks are fitted.



Big-end of connecting rod

Pull rods

The pull rods of $\frac{1}{8}$ in. dia. silver-steel, are made in four pieces: two pieces reach from the leading brake beam to the driving brake beam, and two longer pieces run from the driving beam, through the holes in the brackets described above, along past the trailing coupled wheels and finally to the main brake shaft which lies in gun-metal bushes in the main frames.

The connections are made by the usual forked joints, the forks on the driving beam being doubled, one inside the other. The joints can all be tapped 5 BA, and the pull-rods threaded to suit, after adjustments have been made. The forks can be locked with 5 BA nuts, which is better than pinning them. A general arrangement of the brake layout will be given later, to make things quite clear.

★ *To be continued on May 4*

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

This free advice service is open to all readers. Queries must be within the scope of this journal and restircted to one problem. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W1.

Flash steam

Could you let me know which of your publications deals with model racing boats ?

I would like to know hull sizes, engine capacities and limitations for the different classes, and your opinion on the best class for development of flash steam, which is my main interest. —W.S., Deptford, London SE8.

▲ *"A" class boats have i.c. engines of capacities not exceeding* 30 *c.c., all-on weight,* 16 *lb.; "B" class have i.c. engines up to* 15 *c.c. all-on weight,* 8 *lb., and "C" class have i.c. engines up to* 10 *c.c. all-on weight,* 5 *lb.*

Flash steam boats in all classes are limited by all-on weight, but with no restriction on engine or boiler capacity within that weight. There are no restrictions on hull sizes or design, but the propulsion of the boat must be by mechanical means acting through the water, such as normal screw propellers partly or completely submerged.

These are the rules at present observed by the Model Power Boat Association, for competition boats in Britain. You will probably find the articles on Model Hydroplane Hulls in ME helpful for guidance on general design.

Very few model flash steam boats have been built in recent years. The difficulty of keeping down weight of plant has influenced constructors in favour of the "A" class. Some good results with "B" class boats have been obtained in the past, but there seem to have been no "C" class flash steamers.

Case for RSPCE ?

I have just completed a *P. V. Baker* after very intermittent work over 14 years. It is my first engine. Now I should like to build a second one as a standby, I fancy a modern diesel.

Would it be cruelty to not-so-dumb engines to make a 3½ in. gauge passenger-hauler using the *Kiwi* Mark II suitably geared ? What ratio would be about right for 2 in. dia. wheels ?

My choice of this engine as a power unit is that it seems to be just the job for another first attempt (internal combustion this time)—W.J.C., Winslow, Buckinghamshire.

▲ *The* KIWI *Mark II petrol engine should be quite suitable for this purpose. A suitable form of transmission would be a variable friction gear similar to that illustrated in* MODEL ENGINEER *of* 20 *November* 1958.

The shaft on which the sliding friction disc is mounted should be geared, preferably by a chain, to one of the driving wheels at 2 : 1 *reduction. Normal coupling rods can be used to couple the driving rod if convenient; otherwise they may be geared together by chain and sprockets.*

Motorised IXL lathe

I have a 5 in. IXL lathe which I have converted from its original treadle arrangement to a motorised machine.

I have had some trouble with the headstock bearings, which are of the parallel bore, external taper type. They are made of phosphor-bronze or a similar material. On either end of the front bearing is an adjusting collar by which the bearing is moved in the tapered housing. It is split in one place only to allow it to be closed on the shaft. An ordinary V-thread is used for the adjusting collars, and I have been told that it should be a square thread. Is this correct ?

I would appreciate your suggestions on lubricators for the bearings as I find that the front one requires frequent adjustment if a fairly heavy job is being worked.—J.F.M., Callington, Cornwall.

▲ *The adjustment of the externally tapered bearing bushes of this lathe is inclined to be somewhat critical. Theoretically, the use of a V-thread for the adjustment of the collars tends to apply a contracting force on the bushes when the collars are tightened and thereby to increase the friction on the mandrel.*

This trouble was encountered on the 3½ *in. Drummond lathe many years ago, and was dealt with by using a square thread which did not cause the contracting force.*

We regret that we do not know the manufacturers of this lathe, but we believe that the sole selling agents were Messrs B. Elliot, Victoria Works, Willesden, and so far as we are aware this lathe has not been manufactured since the war. A suitable type of lubricator for the bearings of most types of lathes would be the wick syphon type, manufactured by Messrs Rotherham Ltd, Coventry, and obtainable from most engineering supply stores. An alternative would be the sight feed type, as used on Myford lathes, and obtainable through Myford agents.

Gasoline engine in California

Being in the progress of building a 16 c.c. horizontal two-cylinder four-stroke o.h.v. gasoline engine of my own somewhat unorthodox design, I would appreciate your advice on the following matter.

I plan to employ suction lubrication of the plain front crankshaft bearing and the two crankpins, using crankcase vacuum on the outward stroke as described and illustrated on page 160 of *Model Petrol Engines* by Edgar T. Westbury. The oil holes seem to line up on t.d.c. It is my intention to make the holes begin to line up enough b.t.d.c. in order to be closed again at the beginning of the inward stroke. What is your opinion ?—E.B.S., Long Beach, California.

▲ *It is generally found satisfactory to arrange oil ports to line up exactly on t.d.c. for utilising crankcase vacuum for the feed. There may be some slight advantage in advancing the position of the holes about* 15 *per cent so that the vacuum will operate somewhat earlier, but the ports should be kept open until well after the end of the stroke, as there is delayed action through inertia of the oil, and this may prevent it from flowing properly if the ports close too soon.*

Home-made blueprints

I have been messing about, trying to produce my own blueprints, off tracings in indian ink, with some sensitised blueprint paper—medium, speed 22.

I rigged up a box about 16 in. × 22 in. and in the bottom I put a piece of sheet aluminium, bent roughly parabolic as a reflector. Above it I placed two 100 w. bulbs in batten holders, above this again I laid my tracings, beneath the blue-print paper, facing the lights. Unfortunately after about an hour's exposure, the print

was not much good when I washed it in the domestic bath.

Do I need a mercury vapour lamp and how long should I expose ?—N.K., Wisbech, Cambridgeshire.

▲ *It is essential that the lamps employed should have a very high actinic efficiency as the blueprint paper has a very low sensitivity.*

As you are probably aware, blueprinting machines up to a few years ago were usually fitted with an arc lamp which was traversed over the full length of the print by an electric motor or a weight driven device. This was thoroughly satisfactory, but in more recent years mercury vapour, or other types of fluorescent strip lamps have been used. If these cannot readily be obtained, it is possible that you might be able to get results using three Photofloods which are obtainable from any photographic shop. They produce a good deal of heat on the whole casing, and the machine should be very well ventilated, preferably by a fan.

Exposures would have to be found by trial, but they should not be more than one or two minutes.

Model Engineer EXHIBITION

The next Model Engineer Exhibition will be held at the Central Hall, Westminster, opposite Westminster Abbey, from 16-26 August 1961, excluding Sunday. An announcement about entry forms will be made later in these pages.

Baker gear

As I am contemplating using slide valve cylinders with the Baker gear, can you please suggest a suitable substitute for the cylinder of *P. V. Baker*, together with the name of an advertiser who would supply the cylinders and wheel castings ?

Am I right in assuming that the Baker gear as shown in *The Live Steam Book* will be suitable for this engine as a friend of mine, who knows far more about valve gear than I, has suggested that the eccentric rod would be better driven from the trailing wheels instead of from the drivers.

As I cannot see the advantage in this modification—only an increase in the length of the rod—perhaps you would kindly give your views.—W.J.M., Shoreham-by-Sea, Sussex.

▲ *Reeves of* 416 *Moseley Road, Birmingham* 28, *or Kennion Bros of* 2 *Railway Place, Hertford, will be able to supply suitable wheel and cylinder castings.*

You will not need to alter the Baker gear itself. The combination lever will have to be changed, the connection from the Baker gear coming below the rake spindle which should, therefore, be arranged as high as possible.

The return crank must lie with its pin at 180 *deg. to its original position; it will therefore be of different length.*

It would be very unusual to put the return crank in the trailing crankpin. There would be a slight inaccuracy in the timing owing to play in the coupling rods, but no doubt the locomotive would work all right.

Electric furnace

In *Hardening and Tempering Engineers' Tools*, George Gentry refers on page 81 to the Fulmen Electric Furnace marketed by Mr A. H. Avery.

Could you give me the address of Mr Avery's firm, so that I can get fuller particulars ?—G.G.N., Nantgaredig. Wales.

▲ *The furnace is no longer on the market, but furnaces of* 1.5 *kw. are marketed by A.E.W. Ltd, Imperial Works, High Street, Edgware, Middlesex, and Gallenkamp and Co. Ltd,* 17 *Sun Street, London EC*2.

For St Ninian

I am uncertain of the size of the brass inserts at bow and stern of *St Ninian*. I could, of course, make them the maximum size, but with 10 g. brass at about 5s. a pound, I wish to use only that amount that is necessary.—H.W.W.B., Woodlands, Southampton.

▲ *The stem and stern pieces are merely strips* ¾ *in. wide inserted in the former, to which the plating can be soldered. They come away with the plating in removing the hull from the former. The rounded ends of the hull above these pieces are later stiffened by the addition of the decks, and, if necessary, bulkheads. You will find, however, that the hull, when it comes off the former, is wonderfully stiff and rigid.*

Power boats

I would be grateful if you would let me have the dates of the issues of ME with descriptions of the hard chine hull *Sea Maid* (PB6) and the motor yacht *Mermaid* (PB8).—I.F., Nuneaton, Warwickshire.

▲ *The dates are:* SEA MAID, *ME, March* 13, 1947; *and* MERMAID, Model Ships & Power Boats, *May*, 1949. *Both issues are out of print. It is possible that you may get copies from Messrs Lens,* 50, *Carshalton Road, Sutton, Surrey, who specialise in back numbers.*

Model yacht rigging

I am endeavouring to make a Marblehead yacht, from the Modelcraft plan of *Osprey*. I have completed the hull, mast, booms and so on, and all that remains is the rigging and Braine steering. Unfortunately I have destroyed the rigging sheet of the plan, and the rigging plan which I have bought does not suit my particular model.

This is my first attempt at making yachts, and I am in a quandary.

I have tried to buy another set of Modelcraft plans of *Osprey*, but have been unable to do so.—J.A.W., Bristol.

▲ *Rigging plans for model yachts are not usually very informative. You would be well advised to get* Model Sailing Yachts *by Daniels and Tucker* (*PM*, 10*s.* 6*d.*). *It would give you much useful information about the rigging and about model yachts in general.*

If you went along to the Bristol Model Yacht Club at Bitterwell one Saturday afternoon you would see more in a short time than you would see from plans.

You mention Braine steering gear. Although in some ways this is very efficient, it has now been very largely superseded by the Vane gear.

Busy Bee for Hyderabad

I intend to build Edgar T. Westbury's *Busy Bee* 50 c.c. auxiliary engine and have just received a pamphlet from Braid Bros listing a set of castings and accessories. I have also ordered a few PM books. I am not a regular subscriber to MODEL ENGINEER, but each time I go to Calcutta I pick up a few copies at the Hobby Centre.

I would like to order the set on the construction of the *Busy Bee* engine, beginning with 29 March 1951. Will you kindly let me know if you have these in stock so that I can order them through one of the local booksellers ?

While I am in Europe on a flying course I will pick up a set of *Busy Bee* castings.—J.E.I., Secunderabad, Hyderabad, India.

▲ *The articles on the* BUSY BEE *appeared in ME of March* 29**, April* 12 *and* 26, *May* 10 *and* 24**, June* 7** and* 21, *July* 5** and* 19, *August* 2**,* 16 *and* 30** and September* 13** and* 27. *The issues marked with an asterisk are not obtainable; the others may be had from PM Sales Department at* 1*s., plus* 5*d. postage.*

POSTBAG

The Editor welcomes letters for these columns. A PM Book Voucher for 10s. 6d. will be paid for each picture printed. Letters may be condensed or edited

CHURCHWARD

SIR,—A remark by C.M.K. in his review of *Pacific Steam* has provided me with the courage, or with an excuse, to air my views.

The phrase, "the original Churchward valve events," used by C.M.K of the Gresley Pacifics, is one which arouses my ire. That Gresley revised his valve travel and laps after the exchange trials of 1925 cannot be disputed, and therefore, the phrase must be considered substantially correct. However, for 35 years I have been a regular reader of MODEL ENGINEER, and in that time I have formed the opinion that a certain coterie of undoubtedly well-informd writers has influenced popular opinion towards the idea that Swindon was the birthplace of every worthwhile idea connected with steam locomotive development.

My feelings were originally aroused by a letter from Mr C. M. Keiller to MODEL ENGINEER some time in 1951 or '52, in which he stated that before 1922 nobody but Churchward or Maunsell knew what long lap, long travel valve gear really meant.

Precisely at this time, the craftsmen in the Royal Scottish Museum had just begun what turned out to be a superlative 1 in. scale model of a Caledonian Railway 8 ft Single built to the design of Benjamin Conner at St Rollox in 1859 !

I knew from Colburn's book that these engines had at least 1½ in. laps, and so I approached the museum and was lent the official drawing provided by British Railways.

On studying the cylinder arrangement I found that the lap of the valve stood revealed at 1⅝ in., while the eccentric circle on the general arrangement drawing showed outside the 6 in. dia. of the driving axle, and would approximate to 6½ in. or 6¾ in. As the locomotive had Gooch valve gear, the effective travel of the valve would be at least 6 in. or 6¼ in.

Benjamin Conner said that the long lap and long travel were intended to create a freer outlet for the exhaust, which, owing to the exposed position of outside cylinders was much more sluggish. This, too, was the practice of Robert Sinclair, who preceded Conner on the Caledonian. Lest national fervour be aroused, I may add that Gray of Horseleg motion fame, and the two Beatties on the London and South Western, also pursued this reasoning.

I wrote a letter to ME and received an answer from Mr Maskelyne, of blessed memory, to the effect that I had misunderstood Mr Keiller's statement and that until Mr Churchward had established the 30 in. stroke, the 200 lb. and upwards boiler pressure, and the smoothing of steam ways, the long travel valve with long laps was really of little moment.

In view of the importance of the exhaust phase and the reduction of back pressure which would have a greater proportional adverse effect on the lower-pressed Victorian machines than on the higher-pressed cylinders of the more modern locomotives, I found the reasoning a little unsound. Mr Maskelyne ended his letter by saying that the Churchward idea reached its final development in France, with the introduction of the Super Pacifics and 4-8-0s. I assume that Mr Maskelyne was referring to what were, and still are, the finest examples of steam locomotive design ever to run. If so, for a piece of typical British insularity the statement would take some beating, because in the opinion of most students of locomotive history, De Glehn, Collin and Chapelon did not require to import ideas from Britain or anywhere else. It would be more correct if it had been stated the other way round.

The purchase of the De Glehn Atlantics had a greater effect on Churchward's subsequent work than Churchward's had on other locomotive engineers, great though his influence and his reasoning power were.

But to deny the earlier engineers the credit for *some* exploratory work, is like pulling out some of the foundations of British locomotive engineering; it does no good. Long travels and laps were to a certain extent hampered in the mid-nineteenth century by the lack of suitable lubricants; when a slide valve the size of a dresser drawer had to be shoved about, it took much lubricating, even with a balancing frame on its back.

Churchward's positioning of short direct steam ports right at the end of his cylinders had already been practised for years by the makers of beam engines where, if they had an ordinary slide valve instead of tappet gear, the valve was divided with one valve opposite each end of the cylinder controlling short direct ports.

Churchward's boiler was influenced by American wagon tops, but was fitted with a Belpaire firebox, and Belpaire does not smell like an English name to me.

The divided drive was a legacy from his French imports, and the bar framed bogie was a re-export from the States, the originals having seen the light of day in the works of Bury, Curtiss and Kennedy, admittedly on main frames.

That Churchward was truly one of the great engineers no one can deny, but to make him into a locomotive pin-up boy is to create partisanship.

Stirling. ARTHUR H. BINNING.

We do not think it has ever been claimed in ME that Churchward was the first to use long laps in railway locomotives. We are well aware that Connor used them years before Churchward. But as J. N. Maskelyne pointed out, it was the combination of long laps, long valve travel, piston valves of large diameter and direct steam and exhaust ways, and also high boiler pressure, which produced the results.

Churchward used the 30 in. stroke to make full use of the expansive properties of steam, though he obtained higher speeds with the 26 in. stroke Stars, and Collet got still higher speeds with the Castles.

It is true that Churchward learnt a great deal from both France and the USA but it was his skill in combining the best features of each in one design that earned him lasting fame.

Nobody would dispute that the rebuilt Chapelon engines were more efficient than British locomotives on a purely technical basis, but whether they represented better value for money, taking into account their first cost, maintenance, and depreciation is another matter.—EDITOR.

RIGGING SHEETS

SIR,—In the Readers' Queries reply to T.C. of Cork [ME, March 2] it was recommended that the rigging sheets Nos 2, 3 and 4 from the *Myrmidon* drawings would provide information for rigging the schooner *Prospero*.

I think the rigging plans for the *Moth* or *Water Fairy* would be better.

West Harrow, K. BARRETT.
Middx.

CLOCK WHEELS

SIR,—A reader has enquired about cutting clock wheels. The subject is treated, as in the trade; in *Work*, vol. 49 (Cassells) of 15 May, 1915. Cutting Clock Wheels in Small Lathes was described in MODEL ENGINEER during 1953 on January 27, February 5 and February 12 (vol. 108).

A simple form of worm dividing gear for a small lathe, using a 60-t. clock wheel, was described by George Gentry in MODEL ENGINEER of 23 November 1922 (vol. 47, p. 459).

In finding the blank diameter of involute teeth, two teeth are added to the equation, but in clock wheels *three* teeth are added, as the teeth are more pointed, the pitch circle being further in than the involute.

Tyneside SMEE J. E. D. SCOTT.

PIONEERS

SIR,—The great biographies by Samuel Smiles in the last century covered most of the engineers, and *Great Toolmakers* included all the pioneers of the late 18th and early 19th centuries, such as Maudsley, Wilkinson, Bramhah, Clements, Whitworth and Roberts. These books can be obtained for reading in this country through the regional exchange system, but of course this will not help Mr Burrows. With the effort being made in technical education a cheap edition should be of great value.

During the last war, George Newnes published the weekly *Practical Engineering* under the editorship of the late F. J. Camm (a first-class modeller). Every fourth week or so *Practical Engineering* had an article by Robert Stirling covering all the pioneers in engineering. Perhaps back numbers could be obtained.

MacGraw Hill, who have a branch in Australia, published a history of the machine tool trade which naturally emphasises the American machine tool. The same publishers, in the English edition of the *American Machinist* just after the last war, ran for several weeks an absorbing history of the development of the self-centring chuck.

This is an absorbing study in which you do meet with some frustrating questions. Who, for instance, was the inventor of the micrometer? Moore and Wright plump for James Watt, Brown and Sharpe claim it for their founders, and most histories give Gascoine. Now, who was it?

Shipley, JOHN A. CREYER.
Yorkshire.

NUMBER MYSTERY

SIR,—I was interested in the letter from Mr J. A. Figgins relating to the showman's engines of Enoch Farrar [Postbag, January 26]. If Mr Figgins's records are correct an interesting fact emerges, as he gives the registration number of *Enoch Clifford* (built 1905) as WR 7164 and of *Gladys* (built 1920) as WR 6758.

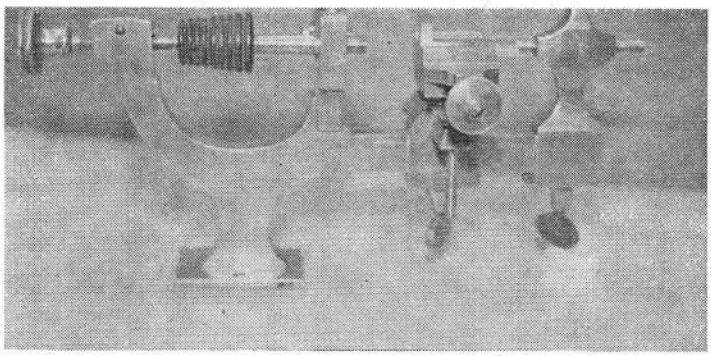
As registration numbers are progressive the later vehicle can have an earlier number only when its original number has become redundant owing to a lapse in the licence for a period; it is then possible to have any particular vacant number on payment of a fed. Can Mr Figgins throw any light on this?

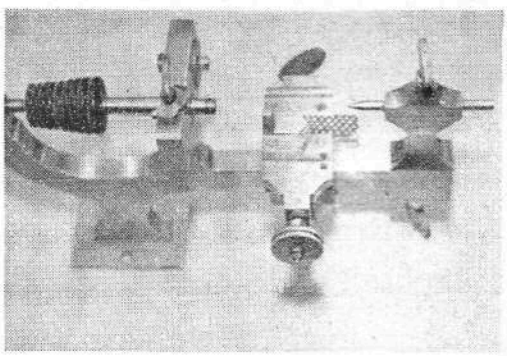
Guiseley, G. H. BUTLAND.
Leeds.

ESSEX TELESCOPE

SIR,—In Little Mount Palomar [ME, January 5] I am afraid that the writer's information on the structural details of the telescope that my friend and I have built is far from correct. The angle at which the telescope is mounted should be identical with the longitude of the place where it is built, so that a star may be followed by rotating a single axis, and not 45 deg. as Peter Haining states.

Epping, Essex. G. J. BALL.





Can any reader identify this jeweller's lathe—probably over a hundred years old—which has been given to the Public Library at Burlington, Ontario? Mr R. H. Gilbert has been asked to restore it. Note that there is no tool clamping device. The centre picture shows the locking screw for cross-slide height at the back. In the picture on the right the cross-slide is at the lowest level—still above centre height

WHO CAN HELP?

SIR,—A jeweller's lathe has been donated to the Burlington Public Library, Burlington, Ontario, Canada, and I have been asked to restore it for display.

I have been unable to locate any identification on the lathe and I wonder if someone could ascertain its approximate age. I believe that it is well over 100 years old.

The entire unit, with the exception of the tailstock shaft, driving shaft, cross-slides and support pins, is made of brass and appears to be hand made. There is no chuck with the unit, and as I am not familiar with what arrangements would have been used for holding the work in a tool like this, perhaps someone can suggest where a replacement might be located. As you can see, the end of the drive shaft is threaded.

The arrangement of the cross-slide

is quite unusual, and we cannot decide how a tool was held. Perhaps ME could be of some assistance here also.

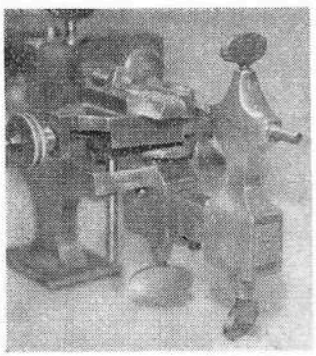
I regret that the quality of the photographs is poor.

I would like to have an approximate idea of what the tool's value would be. The tool is in working condition but there is no intention of using it for other than display purposes.

Burlington, Ontario. R. H. GILBERT.

TREBLE CHANCE A3

SIR,—Now that the list of locomotives for preservation has been published, my fears for the Gresley A3 have been proved well founded. *Mallard* was a certainty of course. She is representative of a fine class of machine, but the A4s, in spite of



all their virtues, are not in my opinion good-looking engines.

No matter, if before they are extinct my treble-chance pool comes home, I will buy an A3 and house it where it will be on view to all.

I wonder how much British Railways would want for *Papyrus* or *Spearmint*. They would also have to sell me one of the old LNER funnels to replace the abortion which now sits on the A3 smokeboxes.

Edinburgh. R. A. FERGUSON.

NEW TO YOU ?

SIR,—I noted with interest Mr P. G. Tucker's remarks in "New to You" on February 2, on the tapping of an injector body with a $\frac{3}{16}$ in. × 60 t.p.i. thread.

I would point out that most manufacturers in Britain would regard this pitch on this diameter as a special and accordingly would not hold stocks of this size ($\frac{3}{16}$ in. × 40 t.p.i. ME being the nearest). Thus, as the tap would be specially made, surely the order to the manufacturer should have read either "Drop through shank" or "Nut tap." The nut tap would have given a greater length of thread in any case. Further, because of the pitch, the manufacturer would have been unlikely to make the tap as carbon steel cut thread. He would have made it in high speed steel ground. For one off, the price from a reputable manufacturer could be about £2-£3 a tap, and £1 if the thread was a carbon cut.

Drills have a soft shank and, therefore, can be marked by a rolling device with size and name. Marking near the flutes, necessarily before heat treatment, would tend to bend the drill, causing a straightening process to be inserted at additional cost.

Romford, Essex. JOHN D. LANE.

MEMORIES

SIR,—How delighted I was to see all the works of a galloper set explained ! I have loved fairs all my life and especially the two steam attractions—the centre engines and the magnificent showman's engines chuffing away.

In my childhood in Edwardian days Jacob Studt's fair machinery came to all the Dolgellan hiring and Easter fairs. I remember vividly being taken on a Studt galloper which had mixed horses and blue and gold cockerels. Between them were motor cars solidly mounted on the platform . This would be in about 1907 when I was five years old.

When I grew up I usually made friends with the drivers and showmen, and I always found that they had time for genuine fairground enthusiasts. I remember that at a fair in Bristol—probably at the Fishponds ground—I saw the driver open his brass wheel regulator on the gallopers, and away went the little centre engine without turning the machine. I do not know what had happened to the drive, but several of the engineers, and drivers seemed to be fishing about between the flywheel and the lantern as if they were trying to catch a chain which had come off. Meanwhile the would-be riders had to sit and wait a few minutes until presently, with a joyful hoot, they were off again full tilt.

It was in Bristol, too, that I saw the only Foden wagon I ever saw generating current with a dynamo fixed on the seat. I do not know if the dynamo was unshipped for travelling, or whether the driver and steersman had to squash in with it between them.

Alas, one hardly ever sees a set of gallopers now, and when one does, what a horrid sight it is—either an electric motor in place of the engine or one mounted to drive the disconnected crankshaft. The last set I saw was at the amusement park in Rhyl. It had an engine made by Walker of Tewkesbury. Some vandal had turned V-grooves in the flywheel face and painted the beautiful little engine—brass and all—a hideous dull grey ! I often wonder what became of Studt's big Burrell *Kitchener*. This name was a very popular one for showmen's engines—like the Fowler described in Mr W. J. Hughes's lovely book.

Studt's was unique, I think, as it was the only engine I have seen that had a jockey or idler pulley mounted on the side of the boiler to keep the bottom strand of the dynamo belt clear of the flywheel brakeshoe. I last saw her at work with her genial driver, Mr Tom Parry, in July 1940 at Towyn.

Nowhere in all the articles that I have read about modelling traction engines, have I seen it explained that all road engines with slide-valves have springs to keep the valve on the face to act as a brake. With no sniftingvalves fitted, these valves are then exactly like piston valves in operation. The Welsh drivers call them compression springs.

I asked one dear old boy if he had ever had an engine run away. In the lovely Mirioneth idiom he replied: "I only went to the wall once when the compression springs failed on a bank !"

Evans Jones, who used to drive a portable Marshall, is an old friend of mine. He was a driver on the Cambrian and then on the Great Western and now lives with his police constable son. He used to go round in the late evening in his own time to see to the fire and make sure that everything was all right. Eventually the engine was scrapped.

I know all the drivers on the local line.

Fairbourne, Merioneth J ROBERT FURLONG

NO GAS

SIR,—I was interested in W. S. Carter's letter "No Gas" in Postbag of March 9, and especially in his reference to the use of a blow-lamp. A furnace with this source of firing has been employed with considerable success at a school where I am metalwork master. One important point in using the flame is its direction into the furnace, for it must wrap itself around the crucible, or the life of the crucible will be rather short.

Full details of the furnace are to be found in *Small Scale Aluminium Casting* (Macmillan).

Dorking, Surrey. LIONEL O. JOSEPH.

CLUB NEWS

Send news and notices to The CLUBMAN, 19-20 Noel Street, LondonW1.

LONDON SHOW

AT the bottom of this page you will see an illustration of one of the finest model locomotives ever to be built. Visitors to the last Model Engineer Exhibition and model engineers in the London area will recognise it at once as the culmination of many hours' work by that well-known model engineer Mr George Cashmore, chairman of the North London SMEE.

The engine is, of course, one of the George the Fifth class 4-4-0s introduced on the London North Western Railway by Mr C. J. Bowen-Cooke in 1910. They had 20½ in. × 26 in. dia. cylinders, driving wheels of 6 ft 9 in. dia., Joy's valve gear, and piston valves. They worked for many years on the principal duties.

Mr Cashmore's model is built to 5 in. gauge and is reported to be a very successful hauler. Its workmanship and painting were much admired by visitors to the Model Railway Club exhibition at Central Hall, Westminster, where it was shown on the Historical Model Railway Society stand.

As usual, Central Hall was filled with beautiful models from 2 mm. scale upwards. Among the locomotives at work on the SMEE track were Mr Ted Moon's Penrhyn quarry engine *Susie M*, Mr Bert Philpott's 5 in. gauge freelance Atlantic *Lady Lynne*, Miss Anne Carter's 0-6-0 Minx *Lorna Doone*, Mr Victor Storey's large and small Tilbury tanks, and the LNER Pacific *Harvester*.

The standard of workmanship was the highest for years.

SCOTTISH AIM

The formation of a Scottish District of the RPS will give all members interested in supplementing the BTC preservation work a chance to help in saving relics of the Scottish pre-grouping companies.

Concentrating on the Caledonian, Glasgow & South Western, Great North of Scotland, Highland and North British Railways, the Scottish district hopes to preserve relics of all kinds, from engines and carriages to the smallest items. It intends to restore them, as far as possible, to pre-grouping condition. The collection will be comprehensive and will include the finest surviving examples of engine and carriage design.

The first step is to find a temporary depot for storage and restoration. What the district wants is a disused or part-used private siding within easy reach of the main centres of population in Scotland. If you know of a possible site the RPS would like to know of it. Write to the Scottish secretary: A. Plevin, 4, Ryal Cottages, Broxburn, West-Lothian.

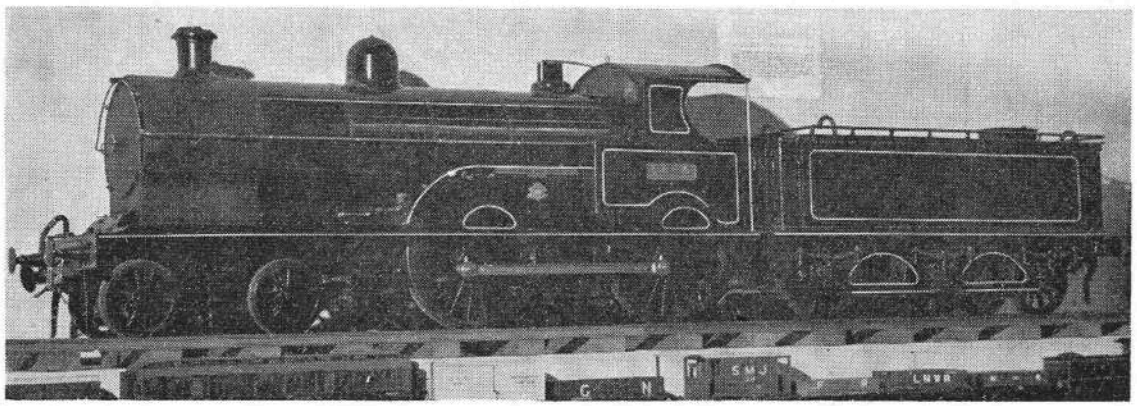
BRISTOL CHANGE

There has been a change of secretary at Bristol SMEE. The post is now held by Mr L. Holland, 14 Bishop's Mead, Cleeve. All correspondence should be addressed to him.

CLUB DIARY

Dates must be sent at least four weeks before the event

April 20 Sutton MEC. Track work.
April 20 Bristol SMEE. Meeting at the Games Room of the YWCA.
April 21 Rochdale SMEE. Lecture on springs by Mr H. Bonser at Lea Hall, Smith Street, Rochdale.
April 21 Ramsgate and District MC. Demonstration on book-binding at Effingham Street, Ramsgate at 7 p.m.
April 21 Coventry MES. Track night.
April 22 Historical Model Railway Society (Midland and South West Area). Lecture by Mr I. H. Smart on the Dartmouth and Torbay Railway at the Mallard and Royal Hotel, Gloucester at 3 p.m.
April 22 City of Leeds SMEE. Track meeting at Temple Newsam.
April 22 SMEE. Headquarters maintenance at 28 Wanless Road, SE24 at 2.45 p.m.
April 23 Wulfruna MPBC. Regatta at West Park, Wolvernampton, SR and RC only.
April 23 Harrow and Wembley SME. Meeting in the morning at the pond in the West Harrow Recreation Ground.
April 23 City of Leeds SMEE. Club visiting day to Temple Newsam.
April 24 Welling and District MES. Meeting at the Welling Library at 8 p.m.
April 24 Sutton Coldfield and North Birmingham SME. Annual general meeting at the Swan Inn, High Street, Erdington.
April 24 North Staffs Model Society. Visit to Meaford Power Station at 7 p.m.
April 25 City of Leeds SME. Track meeting at Temple Newsam.
April 26 Harrow and Wembley SME. Locomotive section night at the Heathfield School, Harrow at 8 p.m.
April 27 Sutton MEC. Track work.
April 28 Thames Ship Lovers' and Ship Model Society. Meeting at the Baltic Exchange at 6.30 p.m.
April 29 City of Leeds SMEE. Track meeting at Temple Newsam.
April 29 SMEE. Visit to the Engineering, Marine, Welding and Nuclear Energy Exhibition.
April 30 City of Leeds SME. Private running at Temple Newsam.
April 30 Maidstone MES. Track day at Mote Park.
May 3 Southampton and District SME. Meeting at the Crown and Sceptre, Bevois Valley.
May 3 Crosby Model Clubs. Regatta at the Coronation boating lake, Crosby.
May 4 Croydon SME. Illustrated lecture on the traction engine by Mr C. R. Randell at the Lichfield Club, Lichfield Road, East Croydon.
May 4 Sutton MEC. Track work.



Advertisements, with remittance, should be sent to Classified Advertisement Department, Model Engineer, 19-20, Noel Street, London, W1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 31.

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Elementary Woodwork by F. H. Harmsworth. The basic woodworking principles are explained to the beginner in simple language and the text is supported with numerous photographs, diagrams and drawings. Consideration is given to the choice of tools and equipment, timber, tool manipulation, joints, various fastenings for wood, construction of equipment for the woodwork shop, etc. The book also explains the basic principles of patternmaking, fretsawing, circular sawing, easy veneering, simple gouge and low relief carving, etc. Also turning, metal fittings, wood finishing, design, etc. 5s. from your bookseller or 5s. 6d. post paid from Percival Marshall and Co. Ltd., 19-20, Noel Street, London, W.1. (U.S.A. and Canada $1.25 post paid.)

Catalogue No. 14. Government surplus and model radio control, over 500 illustrated items, 2s. (refunded on purchase), p.p. 6d. —ARTHUR SALLIS RADIO CONTROL LTD., 93(G), North Road, Brighton.

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The Calculus by G. P. Rawlings, O.B.E., M.A. (Oxon.). Crown 8vo. The mere mention of the word "calculus" bewilders most people, but actually there is nothing very frightening about this branch of mathematics which has been invented and developed for calculations involving quantities that are varying continuously in magnitude, such as the speed of a train or the loudness of a singer's voice. Knowledge of this type of computing is essential in present-day industry and the author explains it in very simple terms, shedding the subject of many of its terrors. Thousands of young people studying for science and engineering diplomas will welcome this concise little handbook with its tables, diagrams and formulae. 5s. from your bookseller or 5s. 4d. post paid from Percival Marshall and Co. Ltd., 19-20, Noel Street, London, W.1. (U.S.A. and Canada $1.25 post paid).

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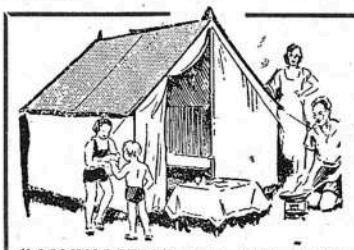

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U.S. Model and Prototype Railway Books and magazines, including "Mixed Train Daily," Cyclopedias, "Model Craftsman" and pre-1947 "Model Railroader." Even odd copies considered. State titles, dates, condition and prices.—Box No. 9932, MODEL ENGINEER Offices.

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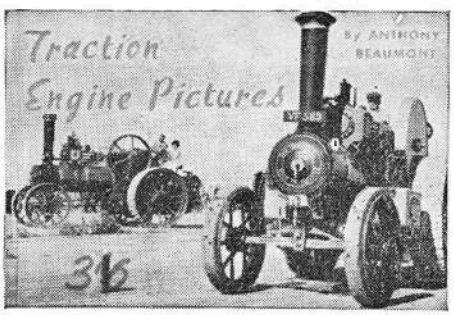

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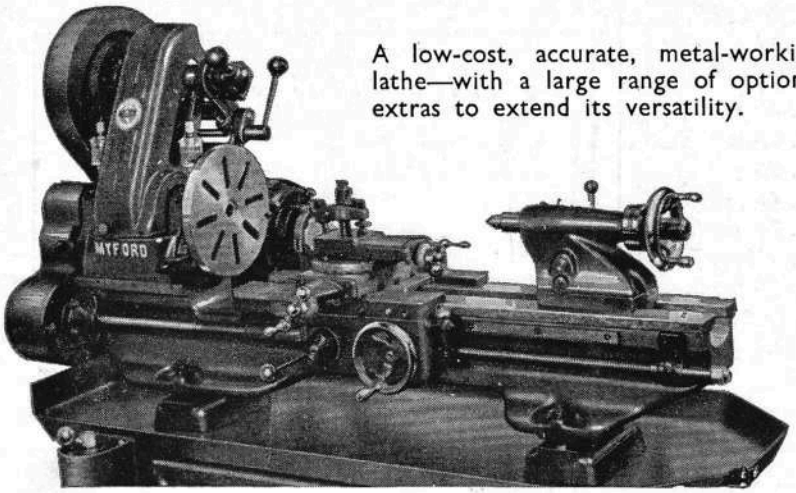

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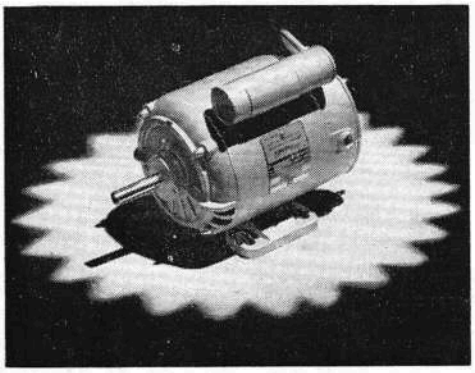

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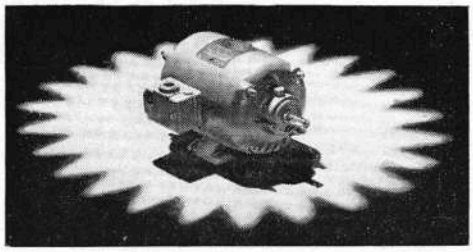

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